

WE SHOW YOU HOW TO NEVER CRASH AGAIN! p.100

JULY 2004

# MODEL Airplane NEWS



**FIRST LOOK!**

# 50 SUMMER HITS!

p.28



Hangar 9  
**CORSAIR**

**SECRETS TO A  
FIRST-PLACE  
FINISH** p.58

**SCALE TECHNIQUE  
RESIN CASTING  
MADE EASY**

**HIGH-TECH HORSEPOWER  
NORVEL'S NEW .40**

**WE FLY**

Great Planes **Venus** > Smooth flyer  
JR Venture 50 3D > ARF heli  
Icare **DLG-800S** > Scale sailplane  
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# MODEL Airplane NEWS

JULY 2004, VOLUME 132, NUMBER 7

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ON THE COVER: Tom Carter puts his Hangar 9 Corsair through its paces. This spectacular warbird is both great looking and a proven performer. (Photo by John Reid.) ON THIS PAGE: JR's new Venture 50 3D ARF heli rips across the sky. (Photo by Deron Neblett.)



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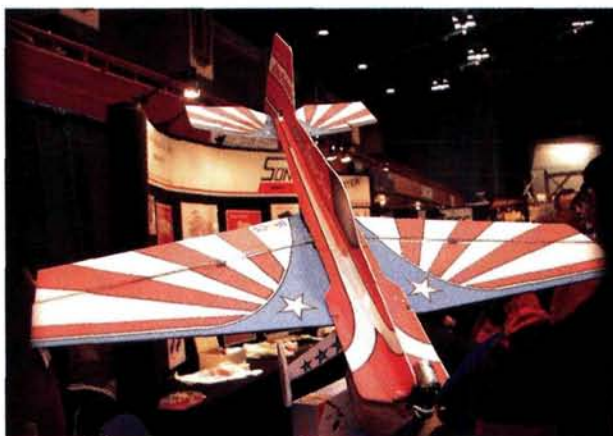
## HOT FOR SUMMER

Dust off your transmitter, fire up your engine, and charge your batteries: the flying season is upon us! The summer of 2004 is here, and with it comes some good news and some bad news. The good news? One look at our special, "Hot for Summer" 10-page version of "Air Scoop" will tell all: there's an unbelievable number of new planes and gear, from wild 3D electrics to scale warbirds to sport planes by the dozen. The bad news? You're going to have to clean out your workshop to make space for all this cool new stuff!

With numerous articles, two books and dozens of awards to his credit, Faye Stilley is arguably the king of iron-on covering. Even masters of covering can learn new tricks, though, and in this issue, Faye shares his latest technique for creating multicolored graphics that are guaranteed not to peel off your plane. How does he do it? See page 58.

"Real Performance Measurement" columnist Dave Gierke follows up his March 2004 "4-stroke Power" guide with this month's article on 4-stroke valve timing, along with a Q&A on these popular powerplants.

Final touches like guns, exhaust stacks and fittings can make your model stand out, but carving all those small pieces can be tedious and time-consuming. "Scale



Techniques" columnist Vance Mosher has a solution: cast these parts out of urethane plastic! In this column, he offers step-by-step instructions and tips on how to build molds and work with molding material.

Our featured construction article

this month is a one-of-a-kind masterpiece: a 30-percent scale de Havilland 62A Tiger Moth designed by Gary Allen. Made out of balsa and ply and built using traditional techniques, this giant spans nearly 106 inches and is ideally powered by a Zenoah G-45 gas engine. The five-sheet plan set includes scale details to build any of several Tiger Moth variants. Though the feature plane is decked out with functional rigging wires, anti-spin strakes, navigation lights, a tailwheel and retractable leading-edge slats on the top wing, this Tiger Moth is no hangar queen: the designer notes that it offers both slow, graceful flight and spirited performance.

And speaking of plans, where would we be without the talents of skilled draftsmen like Joe Demarco? As we went to press, Joe was putting the finishing touches on his 1,000th model airplane drawing—a plan for an upcoming issue of *Model Airplane News*. We celebrate Joe and his contribution to scratch-building in "Final Approach"; turn to page 146 for a behind-the-scenes look at the "man with a plan."

Soft landings!



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JON CHAPPELL

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We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email [man@airage.com](mailto:man@airage.com). Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

### SUKHOI SENSATION

As soon as I saw that gorgeous big Sukhoi on your June '04 cover, I wanted one! The fact that your reviewer gave it high marks was only icing on the cake. I started flying aerobatics a few years ago, and now I can't quit! This airplane sounds like a real pussycat. One question, though: the only engine I have that isn't being used right now is an Enya 1.55 4-stroke. Is that a good powerplant for this bird? Let me know soon; my "plane" money is burning a hole in my pocket!

I appreciate the magazine and read it from cover to cover every month. Keep it up!

Gary Foster [email]

*You're in luck, Gary; the Enya R155 4-stroke would be a good match for the Cermak Sukhoi. This 2.5hp engine should handle 10- to 19-pound planes, so it will have more than enough power for the Sukhoi. Now get that plane, and have a blast!*

GY

### MILITARY CUB

First, thank you for a great magazine that really gets the passion for RC modeling flowing full force! I'm writing because I'm in a predicament. I would like to buy the Sig



1/5-scale Cub and build it as an L-4 Grasshopper. I have seen several other models of the Cub available, including Great Planes'. Can I convert the Great Planes Cub to an L-4? Again, thanks for a great magazine.

John Jaruczyk [email]

To do the L-4 Grasshopper properly, i.e., with clear "greenhouse" observation windows on top of the cabin, you need a model that has plug-in wing panels. When I did my Cub to L-4 conversion, I used a Balsa USA 1/4-scale kit for this very reason. Remember also that you can finish any Cub in a military paint scheme because there were several in Army and Navy service (without the L-4 windows). Hope this helps!

GY

### EVO EVOLUTION

I'm a longtime reader of *Model Airplane News* and enjoy many of the columns and articles each month. I particularly liked the review of the Royal Evo 9 radio in the June issue. I am considering buying one and want to know whether there is any advantage to spending the extra money for the 12-channel over the 9-channel model. I know the obvious answer is the extra 3 channels, but right now, I use no more than 5 or 6 channels, and I see no need for 9 channels, let alone 12.

Dave Bond [email]

*I know what you mean, Dave. I didn't think I would need anything more than the 9-channel model when I reviewed the Multiplex Royal*



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# Show Off.

Evo 9. At least, that was the case until I started my latest project: Hangar 9's 33-percent Extra 330S ARF. This plane uses four servos for the aileron, two for the elevator, two for the rudder, one for the throttle and one for the smoke system. That's 10 servos all together (maybe I should have reviewed the Evo 12!). By using the Royal Evo 12 on this plane, I can have a channel for each servo, so I can use the transmitter to make any necessary adjustments to prevent the servos from binding. I never before thought I would need so many channels, but now I see there could be a need for them. If you can afford the 12-channel over the 9-channel radio, buy it. Another advantage of the 12-channel is that it will store 36 models in its memory as opposed to "only" 20 in the 9-channel. JR

## GLOBAL RC

I just want to thank you guys for a great magazine. I only recently discovered the pleasure of building aircraft. I landed a contract to build two Ultimate Kaos 60s and will send you pics when they are complete. I find I have a talent for building, and all the tips I get out of your magazine have helped me a lot; so thanks, and keep up the good work.

Warren Fry  
Johannesburg, South Africa

We appreciate the feedback, Warren, and hope that you do send us photos of your finished planes for "Pilot Projects." It's great to hear that RC is alive and well and that Model Airplane News is helping modelers—across the globe!  
DC

## ENGINE HELP!

One of our fliers put in a GMS .47 engine last fall (after only six flights), and now we cannot get it to reach high rpm. During level flight, all is OK (idle, high rpm and good transition); however, when we elevate the nose 30 to 45 percent, rpm drops off, the engine slobbers and then it dies. We've cleaned the carb and needles, set and reset both, changed fuel, props, plug, muffler, fuel-tank heights, put the engine on test stand and did it all again. We even tightened backplate bolts and head bolts. We took the head off, and the gaskets were a bit rough. The flat surface felt as though it had small bumps when you rubbed a finger over it. We put in new gaskets and tightened everything down; we even switched carbs with another working GMS 47—and still no rpm.

We are still in the 2-year warranty program and are about to return it, but we would like to overcome the problem here. We've heard about putting high-temp gasket material on the backplate and carb mount, but then we'd void the warranty.

What are we missing? Settings? Head gaskets? Air leaks? Please help.

Keep up the good work in *Model Airplane News*; it is great. Love the "Tips and Tricks" and everything else between front and back pages.

Grant Johnson [email]

Grant, when you say, "One of our fliers put in a GMS 47," I assume you're referring to a crash. Although you didn't mention it, I also assume that you disassembled the engine for cleaning and reassembled it; afterward, you experienced the problem of inadequate wide-open throttle operation.

Since all of your attempts to remedy the situation (including substituting another GMS carburetor) have failed to alleviate the problem, I suggest that the cylinder sleeve has

possibly rotated 180 degrees from where it belongs. You can easily check this by looking into the engine's exhaust with the muffler removed. With the piston moved to bottom dead center, the top of the exhaust port should be the highest of all the ports; if it isn't, the sleeve has been installed incorrectly. Disassemble the engine and make the necessary adjustment. This situation will not adversely affect the mechanical condition of the mill; the engine just won't generate any power.

I'm taking for granted that there was no mechanical damage to the engine's components, such as a scored (scratched) piston due to ingested dirt from the crash. In this case, the engine should be returned to the distributor for repair. Good luck!  
Dave Gierke



S753

## The SkyWriter Smoke System.

It's here! Sullivan's small, lightweight onboard smoke system.

Compatible with all smoke fluids, The SkyWriter features a miniature CE certified microprocessor controlled ESC for adjustable flow rate. It will turn on and off with any transmitter; with a computer radio you can adjust rate or mix smoke rate with the throttle channel.

The pump is Direct Drive, with an ultrasonically welded pump head for maintenance-free high performance. The S753 SkyWriter will run on any battery from 4.8V to 7.2V, and the system includes everything needed except the battery and tank. It weighs less than 4 ounces and is easy to install.

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## TIPS & TRICKS

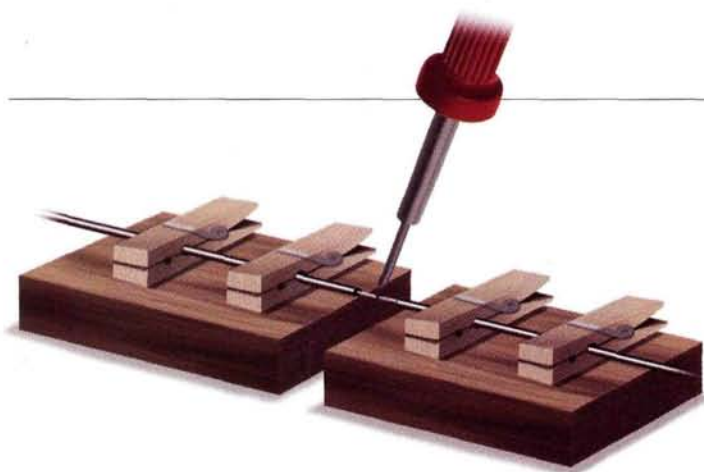
Illustrations by Richard Thompson

**SEND IN YOUR IDEAS.** *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

### far reaching

Sometimes you need to drill a hole in a place that your drill bit can't quite reach. A way to extend the bit's length is to use a fiberglass arrow shaft as an extension. A couple of drops of thin CA will securely hold the drill bit in the shaft. You could also use brass tubes of various diameters to accommodate bits of different sizes. Just be sure to plug the open end of the tube with a dowel so you don't crush the tube when it's chucked in the drill.

Tom Messing, Buffalo, NY



### helping hand

Trying to hold a soldering iron and solder and also keep two pieces of electrical or music wire steady while soldering them together can be quite a balancing act. A simple "third-hand" jig can be made from two blocks of wood and some clothespins. Cut off the fronts of the clothespins to shorten them, and file grooves in them for various sizes of wire. Then epoxy the clothespins to the blocks of wood.

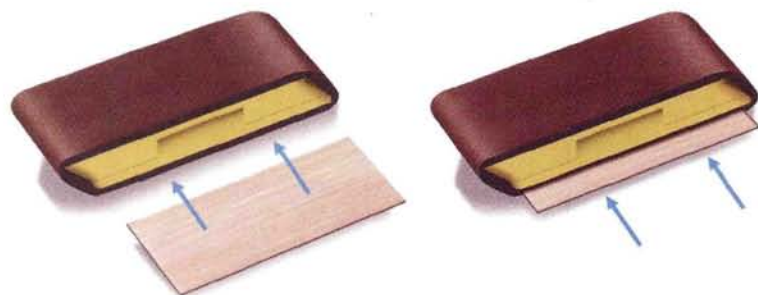
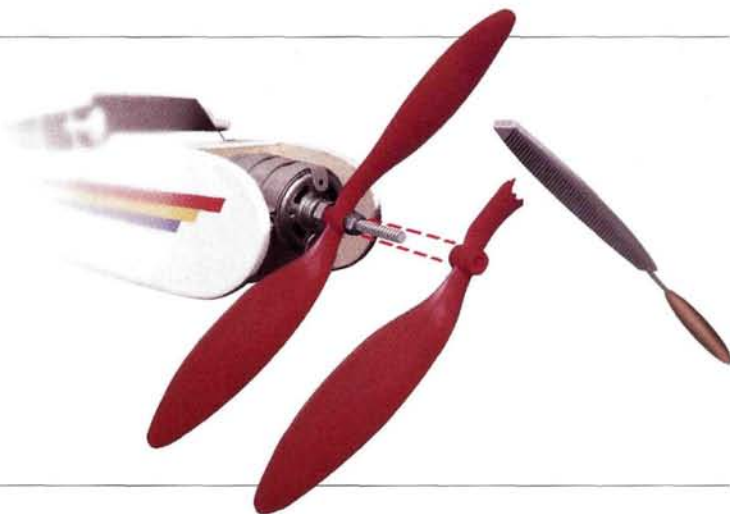
Levent Suberk, Bursa, Turkey



### recycled wrench

On lots of park flyers, a small nut is used to secure the prop to the prop shaft. It's a good system, but finding a metric wrench small enough to fit the prop nut can be a challenge. The next time you break one of those orange props, don't throw it in the trash bin because you can make a wrench out of it that fits the prop nut perfectly. File or sand down the broken section of the prop all the way to the hub, and your prop wrench will be ready to use.

Charles DeCap, East Moline, IL



### firming up

A mini sander is a great tool for smoothing out the rough spots on your latest project. It's small enough to get into tight spots yet large enough to sand larger areas. To make the sander more versatile, cut a piece of  $\frac{3}{32}$ -inch-thick hard balsa or plywood that is the same width as the sander, and slide it between the sandpaper and the rubber pad. This will give you a sanding block that has a hard surface on one side and a soft surface on the other. ✦

Robert Bubello, Meriden, CT



**SEND IN YOUR SNAPSHOTS.** *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

## Nieuport 17

**Claudio De Minico**, Quebec City, Canada

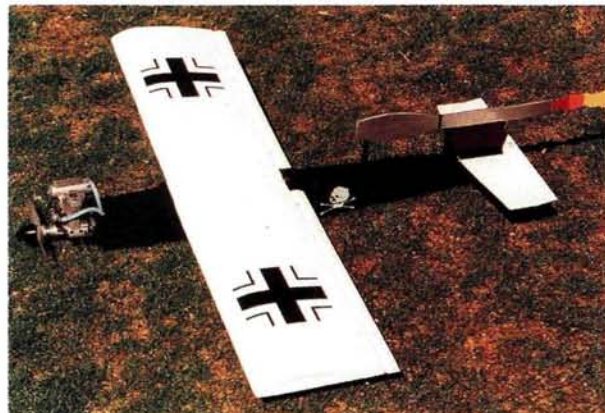
This 1917 Nieuport fighter sports Italian colors in honor of Italy's top WW I ace, Lt. Francesco Baracca, who was killed in action. His mother allowed Baracca's prancing-horse emblem to be used by Italian entrepreneur Enzo Ferrari, who honored the pilot and his squadron by adopting the emblem for his then fledgling car company. Claudio built his Nieuport from a Balsa USA kit. It's powered by a Zenoah 26 engine and covered with World-Tex fabric with airbrushed markings. It has pull-pull controls, rib stitching, a scratch-built Lewis gun and a fuselage-mounted Vickers. According to Claudio, "It's a majestic flyer, especially with the tricolor flag underneath the wings." Ché aeroplano bello!



## Scratch-built German Buzz Bomb

**Gregg Breitegan**, El Paso, TX

Gregg's imaginative "sorta" warbird features a simulated, profile, pulse-jet engine that serves as a fixed rudder. He tells us that during one flight, the engine separated from the fuselage, but he was able to land the plane, anyway! (He subsequently reinforced the engine mounting with a dowel attached to the fuselage.) Gregg also notes that with the engine throttled back, the cut-down muffler simulates the "putt-putt" sound of a real pulse-jet unit. He hand-launches the Buzz Bomb, and since it flies off grass, it doesn't need landing gear. The 35-inch-long, 2¼-pound model is powered by an O.S. 25 FP engine and controlled by Airtronics gear; the foam wing is covered in MonoKote. Hey, Gregg: TLAR!\*



\*That looks about right!



## de Havilland Beaver

**Gary Owen**, Seattle, WA

With a color scheme inspired by a full-scale floatplane that Gary saw at the Kenmore Air Harbor Seaplane base in Seattle, he built this 8-foot-span de Havilland Beaver using a Unionville Hobby Supply kit; it has scale EDO floats and kick-up rudders. It gets its power from a Saito 100, and according to Gary, "It flies great and looks very scale in the air."



## J-3 Piper Cub

**William Wheeler**, Inola, OK

Shown here with his daughter Lily, Bill tells us that his beautifully detailed 1/3-scale Piper Cub replicates those built in Ponca City, OK, between September 1946 and March 1947. The Oklahoma-built Cubs could be identified by the vertical registration numbers on the tail. Bill's model is from a Balsa USA kit; it has a 140¾-inch wingspan and an 88¾-inch-long fuselage, and it weighs 34 pounds. An O.S. Pegasus 3.20 4-stroke powerplant and Futaba radio gear are just the beginning; the list of modifications he has made is as long as your arm. No wonder; he has put more than 3,000 hours into it! Take the Click Trip on our website to view Bill's terrific slideshow, including great detail and flight shots.

**click trip**  
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## Scratch-built 28-percent-scale Cassutt Racer

**Stan Zdon, Coon Rapids, MN**

Stan's Internet research resulted in his building this good-looking, 58-inch-span Cassutt Racer. The 12-pound plane gets its power from an O.S. 91 Surpass engine swinging an APC 14x8 prop. The front of the plane (from the wing forward) is made out of fiberglass and painted with white 21st Century paint, as are the fuselage above the wing and the landing gear. The rest of the plane is covered in 21st Century fabric. The red and yellow trim on the wing and the tail is made out of UltraCote, and the green trim is custom-mixed Rustoleum. Radio gear includes an Ace transmitter, a Hitec receiver and servos from Hitec and Airtronics. Stan tells us that he learned a lot of new procedures from this project, including how to engineer the structure, draw the plans, form the front end out of fiberglass and vacuum-form the canopy. Great job!

## C-47

**H. Wayne Berens, Ewing, NJ**

Powered by dual Wankel engines, Wayne's C-47 was modified from a Top Flite DC-3 kit and took him two years to complete. The model weighs 13 pounds empty, and modifications include scale-like functional exhausts, scale oil coolers and air filters on both engine nacelles, Pitot tubes, a tailwheel, an "astro" dome and antennas. The twin Wankels have custom mounts and mufflers, and the plane features retracts, a full electrical system, operational flaps and onboard glow drivers coordinated with landing lights. Two additional 8-ounce fuel tanks are installed in the fuselage to provide longer flight times. Wayne says that the plane flies well, and the twin engines supply very realistic sound effects.



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## Fokker Dr.I

**Richard Werner**, Lakeland, FL

This well-done Fokker Dr.I from a Proctor kit is Richard's first attempt at building a true-to-scale RC project. The 47-inch-wingspan triplane has pull-pull controls, is covered in Nelson fabric and flat clear dope and is powered by a Salto 56 4-stroke turning a 13x6 wooden prop. Richard writes, "Much like the full-size, it's a disaster waiting to happen (on the ground). Pointed into the wind, off smooth grass, it's a pure pleasure to fly and to watch!" ✚



## Astro-Hog

**Kenneth Rood**, Valatie, NY

Kenneth's 72-inch-span Sig Astro-Hog is covered in UltraCote and powered by a Thunder Tiger Pro 61 engine swinging an APC 12x6 prop. The Astro-Hog pioneered RC aerobatics when it was introduced in 1957, and today's sport fliers still enjoy its stable, gentle flight characteristics. Ken's Astro-Hog runs on five servos and is controlled by Futaba radio gear, and he tells us that "The plane flies great with minor trim adjustments."

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**R**eady for the summer flying season? We've picked more than 60 of our favorite summer releases for this special 10-page "Air Scoop" feature, so whether you're looking for giant-scale performance, backyard convenience or the latest in gear, you'll find it here. Note: the editors are not responsible for helping you clean out your workshop to make room for all the new planes and gear!

# HOT FOR SUMMER



## **ELECTRIFLY SUKHOI SU-31 ARF**

With full-house control and ultralight foam and balsa construction, this park flyer offers a wide flight envelope that will please intermediate and expert pilots. Add its scale outline and trim scheme, and you'll have a park flyer that looks as good as it performs! You need only add a Kontronik Fun 400-36 brushless motor, 4.2:1 gearbox and 4- or 5-channel radio (flaperons optional), and you'll be flight-ready in just a few hours. The Sukhoi comes with all basic hardware, wire landing gear and a tailskid. Specs: wingspan—39.4 in.; wing area—555 sq. in.; weight—25.9 oz.; length—45.5 in. Cost? Only \$120.

ElectriFly; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; [electrifly.com](http://electrifly.com).







## HOBBY LOBBY ALFA MODELS LAVOCHKIN LA-7

Stepping up to a warbird doesn't get any easier than this: a plane that's completely built and painted and ready for you to install the motor and radio system! Molded of hollow foam, many of its surfaces are hardened to resist dings. The 33-inch-span Lavochkin is designed for 3-channel operation and requires a Speed 300 motor geared 5:1, an 8-cell, 1100mAh NiMH battery and 2 microservos. With a flying weight of just 16 ounces, hand launches are quick and easy.

Hobby Lobby Intl. (615) 373-1444; hobby-lobby.com.

## ELECTRIFLY LITHIUM-POLYMER BATTERIES

We all know that lithium-polymer batteries provide the necessary power for longer-flying electric planes. Now, Great Planes' new Electrify Li-poly batteries provide more power and longer flight times by offering the highest-energy-density cells available. All packs come assembled with leads attached and housed in a soft, thin-foil wrapping.

These new high-discharge cells are capable of a higher current output

and have a low self-discharge rate so there's no need to trickle-charge or cycle. They also feature "Safe Charge"—over-charge protection circuitry that prevents you from over-charging the batteries.

Available in 2- and 3-cell (series) packs that range from 350mAh to 1500mAh, the street price is \$29.99 for the 2-cell, 350mAh pack and \$53.99 for the 3-cell, 1500mAh pack.

Electrify; distributed by Great Planes Model Mfg. (217) 398-6300; (800) 682-8948; electrify.com.



## ZDZ 160 CHAMPION

New from RC Showcase is the ZDZ 160 B2 Champion. With a hopped-up version of the popular 160 B2 RV engine, the Champion upgrades include a new, lighter hub and prop pressure plate, a Tillotson carburetor for better fuel delivery, a lighter titanium central prop bolt, a rotary induction design and attractive black cylinders to help dissipate

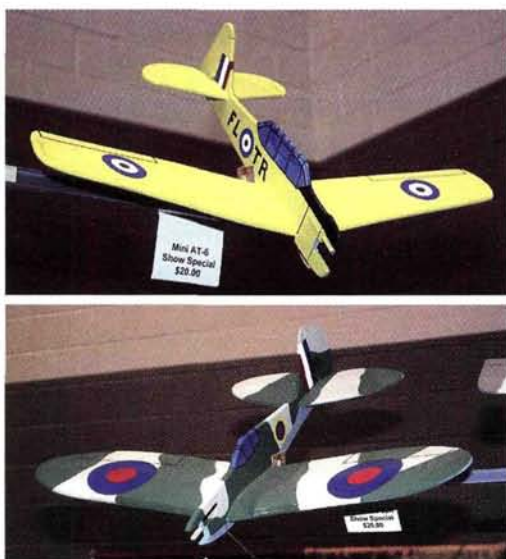
heat. Factory-installed, adjustable choke and throttle ball links are also included. Priced at \$1,375, the ZDZ 160 B2 features factory break-in and weighs only 6.6 pounds (7.8 pounds with mufflers, ignition, battery, etc.).

ZDZ; distributed by RC Showcase (301) 374-2197; rcshowcase.com.

## BALSA PRODUCTS FUN FOAM FLYERS

These inexpensive, all-foam flyers are great for indoor and calm-weather outdoor flying. They each weigh less than 4 ounces, so hard landings rarely damage them. They come with step-by-step, photo-illustrated building instructions. The Spitfire and Mini AT-6 are just two of this line of indoor flyers; they use GWS 280 motors and have 25.75-inch wingspans. These 22-inch-long planes cost just \$22.95 each.

Balsa Products (732) 634-6131; balsapr.com.



## HANGAR 9 TWIST 40 ARF

Hey; who says a plane needs a big wingspan or a big price tag to be capable of extreme aerobatics? Not Hangar 9. Its .40 Twist ARF has light wing loading and supersized control surfaces to give it 3D moves that will make your flying buddies jealous. The wing measures 47.75 inches, with a generous 747 square inches of area to carry its projected 5- to 6-pound flying weight. With a .40 to .58 2-stroke or a .50 to .72 4-stroke, it will be ready for any maneuver!

Hangar 9; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

**SUMMER  
FAVORITE**



## SR BATTERIES FOKKER E-1 EINDECKER

This new 1/4-scale kit uses balsa and wood construction and carbon-fiber tube spars and leading edges for strength and weight savings. The kit also includes highly detailed, full-size CAD plans, laser-cut wood parts, a spun aluminum engine cowl, bent music-wire landing-gear parts and a laser-cut assembly jig for proper rib spacing. It features ailerons and a full flying rudder that pivots on a composite tube assembly—no hinging required! The tailskid and the main landing gear are shock absorbing, and the firewall comes laser cut for the popular Zenos G-26 gas engine. The Eindecker is also designed for electric power! SR Batteries (631) 286-0079; [srbatteries.com](http://srbatteries.com).



## BIGAIRPLANES 35-PERCENT PITTS MODEL 12

The new 35-percent Pitts Model 12 biplane from Bigairplanes is sure to become a popular aerobatic favorite. A smaller version of its popular 41-percent-scale version (108-inch span), it has a 93-inch top wingspan and an 88-inch bottom span. The finished weight is 35 to 40 pounds, and it can handle up to a big 150cc twin-cylinder engine. The laser-cut short kit of the Model 12 comes with full-size CAD plans, a fiberglass cowl and pants, a molded canopy and aluminum landing gear and cabane strut; it costs \$590. If you want really big biplanes, Bigairplanes has you covered! Bigairplanes (860) 738-4605 days; (860) 379-4033 nights and weekends; [bigairplanes.com](http://bigairplanes.com).



## BME AIRCRAFT PITTS SPECIAL CHALLENGER

If you know the famous airshow pilot Sean Tucker, then you'll recognize this model of his impressive "Team Oracle" Pitts Special Challenger biplane. This beautifully built 27-percent-scale Challenger ARF is ideal for intermediate and advanced fliers. Priced under \$500, it features: laser-cut balsa and ply construction; a built-up fuselage; one-piece, built-up, bolt-on wing panels; fiberglass cowl and wheel pants; aluminum landing gear; factory-drilled hinge-pin holes, and more. With a 64 1/2-inch top span, the model weighs 15 pounds with a BME 50cc engine. BME Aircraft; distributed by Hardsilk Marketing (604) 638-3119; [bmeaircraft.com](http://bmeaircraft.com).

## ZOMBIE PILOTS LOOK ALIVE SERIES

Zombie's custom-painted pilots include figures from Aces of Iron, Vailly Aviation, Williams Bros. and Lifelike Pilots. Sizes range from 1/7 scale to 40 percent for warbirds, sport scale, 3D and IMAC projects. Zombie uses 100-percent UV- and temperature-resistant paints. Shown is a 1/5-scale "Chuck" bust from Aces of Iron; it costs \$74.95 painted. Zombie Pilots; distributed by Hangtimes Hobbies (631) 610-5169; [hangtimes.com](http://hangtimes.com).



## DU-BRO PRODUCTS FILLIN' STATION

Everything you need, right on top of your fuel bottle! The Fillin' Station comes with a Kwik-Fill fuel pump (works with gasoline and glow fuel); an O-ring-sealed Kwik-Fill fuel cap fitting; silicone fuel tubing (Tygon gasoline fuel line sold separately); built-in tool holders for screwdrivers, ball drivers



and other tools; a Kwik Start glow-plug igniter (charger included); an anodized glow-plug holder; and a four-way wrench. Prices: \$64.95 (complete version) \$39.95 (w/out Kwik Start & wrench). Du-Bro Products (800) 848-9411; [dubro.com](http://dubro.com).

## GLENN TORRANCE MODELS FOKKER D.VI

The new Fokker D.VI from Glenn Torrance Models (GTM) is a unique and seldom modeled subject. Like all GTM kits, the D.VI is 1/4 scale and features museum-quality design and craftsmanship. Sort of like a Fokker triplane with a pair of D.VII wings, the D.VI's fidelity to scale is typical of all GTM products. The kit includes laser-cut wooden parts, formed metal struts and fittings, an aluminum engine cowl and CAD-drawn plans. Priced at \$375, the D.VI is a great value for anyone who is interested in WW I scale.

Glenn Torrance Models (919) 423-8530; [gtmodels.com](http://gtmodels.com).





## YELLOW AIRCRAFT CURTISS P-40E

The long-awaited P-40 kit is now available! Typical of all Yellow Aircraft kits, the 86-inch P-40 includes a one-piece molded-fiber-glass fuselage with integral vertical fin (panel lines and scale details are molded in), an engine cowl, sheeted-foam wing panels and tail surfaces; custom pneumatic scale retracts are also available. It's suitable for 40- to 60cc gas engines. Available accessories include built and painted cockpit interior, custom-machined 8-spoke aluminum wheels, 4 7/8-inch-diameter tires, retractable tailwheel, scale aluminum spinner with machined backplate and offset hinges.

Yellow Aircraft Intl. (781) 674-9898; yellowaircraft.com.



## NORTHEAST SAILPLANE CP 20 BRUSHLESS MOTOR

The new American-made CP 20 brushless motor will soon be available from Northeast Sailplane. This high-quality motor comes with a 2-year factory warranty and has 16mm mount spacing and 2.3mm shafts like standard Speed 400 motors. Geared versions are suitable for planetary gearboxes and the GWS EPS 400 series gearbox. Specs: maximum rpm—50,000; maximum efficiency—87 percent; cells—6 to 10; diameter—20mm; length—45mm; weight—60g/2.1 oz. Northeast Sailplane Products (802) 655-7700; nesail.com.



## CARL GOLDBERG PRODUCTS 30-PERCENT ULTIMATE ARF

Just the ticket for wild aerobatic fun, this ARF has an all-wood airframe and one-piece wing assemblies. With accurate and lightweight construction, the big Ultimate provides great slow-speed flight, and it has the strength to carry a 4.2ci engine for amazing performance. Priced under \$850, this hot performer has a lot to offer. Airfoil tail surfaces provide improved flight characteristics and the double-beveled control surfaces provide maneuverability for exciting 3D performance. A fiberglass cowl and wheel pants, aluminum landing gear, cabane struts and formed canopy are also included.

Carl Goldberg Products (678) 450-0085; carlgoldbergproducts.com.



## SIG MFG. FIRST PLACE 6.8ci

For those who are looking for serious power in a gasoline engine, the First Place 6.8ci twin-cylinder



boxer engine delivers 75 pounds of thrust and weighs 116 ounces (including mufflers).

Like all First Place engines, the 6.8 includes piston and cylinder assemblies from Husquarna and Sachs/Makita and features CNC-machined components produced from billet aluminum and steel. The engine comes with electronic-ignition, smoke-ready, tig-welded mufflers; complete instructions; and a 1-year limited warranty.

Sig Mfg. (641) 623-5154; sigmfg.com.

## SHOWSTOPPER



## GREAT PLANES MODEL MFG. SUPER STEARMAN 1.20 ARF

This large, IMAA-legal red-and-white classic plane is sure to draw a crowd at the field. This expertly MonoKote-covered Super Stearman features built-up balsa/plywood construction and a detailed cockpit with two scale pilot figures. Other fine scale details include: a dummy radial engine; polished-aluminum spinner; painted and formed interplane struts and cabanes; and fiberglass wheel pants and cowl. Specifications: wingspan—71.5 in.; wing area—1,466 sq. in.; weight—14 to 15 lb.; wing loading—22 to 23.5 oz./sq. ft.; length—56.75 in.; engine—.91-1.20 2-stroke or 4-stroke; price—\$399.99.

Great Planes Model Mfg. (217) 398-6300; (800) 682-8948; greatplanes.com.



## DJ AEROTECH ROADKILL B-17 & ME 109

The Roadkill line of lightweight, profile models continues to impress us with its good-looking indoor flyers. New for summer are this Boeing B-17F and Me 109, featuring laser-cut

balsa and plywood parts, all hardware required and complete motor systems. Add an actuator control system and some light paint, and you'll be ready for action. The B-17 costs \$124.95 and the Me 109, just \$48.95.

DJ Aerotech (937) 773-6772; djaerotech.com.



## SIG MFG.

## FOKKER D.VII

Highly maneuverable at all speeds and altitudes, the full-size Fokker D.VII proved to be more than a match for any of the British or French fighter planes of 1918. Now Sig brings these same great qualities to a new electric park/indoor flyer! Assembly couldn't be easier: the Fokker's one-piece foam wings, plywood cabane struts, molded-plastic cowl and cockpit and robust landing gear with lightweight wheels and covers allow this airplane to go together quickly. Because it's constructed of lightweight (yet strong) injection-molded foam that's factory finished, you need only apply the supplied decals. A powerful 180 motor with gearbox, a wooden propeller and a fully illustrated assembly manual complete the package.

In a gentle breeze outdoors, the Fokker breaks ground quickly and points to the sky. If the weather isn't ideal for outdoor flying, take your Fokker to the gym and tear up an indoor arena. Specs: wingspan—32.7 in.; wing area—273 sq. in.; length—23.7 in.; weight—10.7 to 10.9 oz.; radio req'd—3-channel w/2 miniservos.

Sig Mfg. Co. Inc. (800) 247-5008; (641) 623-5154; [sigmfg.com](http://sigmfg.com).



SUMMER FAVORITE

## IKARUS USA

## SHOCK FLYERS

These three profile performers are sure to give your next flying session a jolt. New from Ikarus USA, the EDGE 540 aRtistic, the EXTREMA 330S and the Super Star aerobatic electric make excellent indoor 3D trainers for aspiring aerobatic aces. Their printed-foam profile fuselages, wings and surfaces are reinforced with carbon-fiber spars and struts to withstand extreme maneuvers and the occasional close encounter with walls at your indoor flying site. All three are available with and without Ikarus' Shock Power Set that includes a specifically chosen, 3D geared motor and CAD/CAM-designed prop. Each sells for \$68 (\$36 without the motor set). Just add your choice of 4-channel radio, 3 microsensors and an ESC, and you'll be ready to bring some electricity to your next indoor meet!

Ikarus USA (239) 690-0003; [ikarus-usa.com](http://ikarus-usa.com).

HACKER BRUSHLESS MOTORS  
MASTER PROGRAMMING BOX

The new Master Programming Box from Hacker connects directly into the Master Series controllers for at-the-field adjustment and fine-tuning. You can select forward and reverse motor rotation, set the controller for Ni-Cd, NiMH

or Li-poly cells and adjust the Li-poly voltage cutoff point, prop brake type, motor timing (0 to 30 degrees) and select operating frequency, throttle endpoints, throttle curves and acceleration type (soft, medium, or hard).

Hacker Brushless Motors (480) 726-7519; [hackerbrushless.com](http://hackerbrushless.com).

HOUSE OF BALSA  
ELECTRIC ZAP MACHINE

The new Electric Zap Machine features all balsa and ply construction and requires no covering! After you finish this 29.75-inch-span, no-covering-needed (NCN) model, simply apply the self-adhesive, full-color decal set and spray with a clearcoat finish. The kit includes full-color, photo-illustrated instructions, rolled CAD plans, laser-cut parts, a fully sheeted wing and high-quality Du-Bro hardware. Priced at \$69.95, the Electric Zap Machine requires a 3-channel radio system, long-can Speed 400 motor, an ESC and an 8-cell battery pack. House of Balsa (760) 246-6462; [houseofbalsa.com](http://houseofbalsa.com).



## SHOWSTOPPER

## WING MFG.

## STUKA DIVE-BOMBER

Wing Mfg.'s new Junkers JU-87 Stuka dive-bomber has a 67.75-inch span and is designed for .60 to .80 2-stroke engines. A new version of the old D&B Model Aircraft kit, it features a fiberglass fuselage with molded-in fin, precision-cut foam wing and stabilizer cores and weighs 7.5 to 8.5 pounds.

Wing Mfg. (269) 665-9630; [wingmfg.com](http://wingmfg.com).





**SUMMER  
FAVORITE**

### FLYZONE VENTURA EP RTF

With the Ventura, FlyZone has raised the bar when it comes to ready-to-fly planes. This 40-inch-span model comes with an FM transmitter and standard micro equipment that includes two microservos and a speed control—all installed! You need only mount the tail section and secure the one-piece, laminated foam wing with rubber bands. Beginners will love the Ventura's stability and self-righting capabilities, and intermediate fliers will appreciate its long flight times and the way it can really move out! It features a polypropylene fuselage with a lift-up canopy for easy battery access and a reinforced foam wing that's surprisingly light yet strong. The single-stick, 3-channel FM radio offers elevator, rudder and proportional throttle control and features red and green LED indicators, servo-reversing and a charging jack for optional Ni-Cds. It also comes with an 8.4V NiMH battery pack (for flights of more than 10 minutes!), a 12V field charger and a spare folding propeller. Specs: wingspan—39.75 in.; weight—16 oz.; length—25.4 in.; requires 8 AA batteries for the transmitter. The Ventura has a street price of just \$129.99.

FlyZone by Hobbico; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; hobbico.com.



### TECH BREAKTHROUGH

### EAGLE TREE SYSTEMS FLIGHT DATA RECORDER 2

Now half the size and weight at about 1½x2 inches and 1 ounce, this latest unit has even more features, such as servo positions for 4 channels and receiver-battery voltage. It logs many things: airspeed from 9 to 290mph; altitude beyond 25,000 feet; climb rate; and two sets of temperatures up to 424 degrees F. We don't know of any device designed for RC that packs so much data into such a small package. With the included PC software, you can download and store information about any flight to evaluate setup and tune for increased performance. That's a whole lot of info for the \$170 asking price! Eagle Tree Systems (888) 432-4744; eagletreesystems.com.

### QUIQUE AIRCRAFT CO.

Aerobatic superstar Quique Somenzini has teamed up with famous TOC builder Wayne Ulery to produce high-quality, high-performance ARF kits. The first model off the building board is a version of Quique's TOC Yak 54. The model has a 72-inch wingspan and is designed for a 1.20 to 1.80 glow engine. Other models are planned with wingspans of 82, 102 and 120 inches. After being tested for many hours, these impressive ARF Yaks promise to be great 3D aerobatic performers. Quique Aircraft Co.; somenzini.com.



### MULTIPLEX USA SONIC LINER

The new, unique-looking Sonic Liner plane from Multiplex flies on two Speed 400 motors in a pusher configuration. This visionary model, constructed of white foam, incorporates canard elevators and ailerons for flight control. Specs: wingspan—45.28 in.; wing area—651 sq. in.; weight—3.5 lb.; wing loading—12.4 oz./sq. ft.; motors—Speed 400 (2). Multiplex USA (858) 748-6948; multiplexusa.com.



### ROBBE USA ORNITH 46 HELICOPTER

Who says you can't have it all? With the new, almost-ready-to-fly Robbe Ornith 46 helicopter, you get the precision flight control of CCPM that's necessary for beginners as well as the power demanded by experts for

advanced aerobatics. A full complement of bearings makes the Ornith a smooth performer. Specs: main rotor diameter—48.5 in.; length—45 in.; weight—7.5 lb.; engine—.46 to .50 2-stroke heli; price—\$300.

Robbe USA (860) 677-7278; robbeusa.com.



### KMP OV-10 BRONCO

Kondor Model Products (KMP) is known for high-quality scale items, and its newest release lives up to that reputation.

The OV-10 Bronco is a built-up balsa/plywood kit that includes a fiberglass nose and engine cowls. It even includes retractable landing gears! Specs: wingspan—95 in.; motors (2)—.61 2-stroke, .72 4-stroke; price—\$499.99.

Kondor Model Products (253) 859-7788; kmp.ca.



## CHIP HYDE DOUBLE VISION

The Double Vision 3D ARF with its big, double-beveled control surfaces has rock-solid slow-flight characteristics for perfect 3D performance. The 75-inch biplane has 1,600 square inches of wing area and is set up for four aileron servos, dual elevator servos and one pull-pull rudder servo. The model weighs 13.5 to 15 pounds and is intended for a 50cc gas engine. Priced under \$620, the kit includes plug-in wings and stabilizers, hinged surfaces, a removable canopy, a fuel tank, a fiberglass cowl and tuned-pipe tunnel, eight 6061 machined-aluminum ball-bearing control horns and a tailwheel assembly.

Chip Hyde; Chiphhyde.com.



## SHOWSTOPPER



## GREAT PLANES MODEL MFG. LITTLE TONI SPORTS RACER ARF

When you see this plane, you'll have to own one! The new Little Toni Sports Racer ARF will get your adrenaline going. A duplicate of the full-size Formula 1 pylon racer, this IMAA-legal aircraft comes with a painted fiberglass fuselage, wheel pants and cowl. A built-up balsa/ply, balsa-sheeted wing incorporates dual aileron servos for precision and authority. Specifications: wingspan—63 in.; wing area—775 sq. in.; weight—7.25 to 8.25 lb.; wing loading—21.5 to 24.5 oz./sq. ft.; length—56.5 in.; engine—.61 2-stroke or a .91 4-stroke; price—\$269.99. Great Planes Model Mfg. (217) 398-6300; (800) 682-8948; greatplanes.com.



## BALSA USA FOKKER D.VII

The newest addition to the Balsa USA line of high-quality, all-wood built-up kits is the 1/4-scale Fokker D.VII. It features full-size rolled plans, bent landing gear, wire parts, hardware and precision die-cut, balsa and aircraft-grade plywood parts. Priced at \$295.95, the 88-inch model has a wing area of 2,225 square inches and is 68 7/8 inches long. It's suitable for a 25- to 35cc 1.50 4-stroke or a Zenoah G-26.

Balsa USA (800) 225-7287; balsausa.com.

## SKY & TECHNOLOGY SRX & CRX RECEIVERS



No more receiver crystals needed! The programmable 8-channel SRX is compatible with most FM/PPM transmitters and works with two transmitters simultaneously for easy student/instructor control. It costs \$72.

The conventional 7-channel CRX FM receiver is compatible with any single-conversion crystal and is small and light, so it's ideal for park and backyard flyers. It costs just \$32.

Sky & Technology (310) 527-0002; sky-technology.net.

## CENTURY HELICOPTER PRODUCTS HUMMINGBIRD ELITE CP

Heli pilots will really appreciate the convenience and simplicity of the microsize Hummingbird Elite CP.

With its new collective-pitch design, it can fly indoors and out, and it's great for learning aerobatics and aggressive 3D-style aerobatic maneuvers. Hummingbird Elite CP specs: main rotor diameter—20.5 in.; length—18.5 in.; motor—Speed 370 (included); price—\$99.95.

Century Helicopter Products (408) 451-1155; centuryheli.com.



## CENTURY JET MODELS F-18E SUPER HORNET

"Super" is just the word to describe Century Jet's F-18E Super Hornet. The wingspan is 79 inches, which works out to 1/2 scale. The fuselage is one-piece fiberglass that can accommodate single or twin turbines. The wings and tail surfaces are composite, and the plane features twin, 1-gallon fuel tanks. The canopy and engine hatch come molded into the fuselage, and a functional canopy kit is available, as is a detailed cockpit, pilot and scale landing gear. Fully decked out, the F-18 will weigh 39 to 42 pounds and will require 6 to 10 servos.

Century Jet Models (502) 266-9234; centuryjet.com.



**SUPERKRAFT  
WACO UFP7**

This scale ARF model features all-wood construction and comes with a painted fiberglass cowl and wheel pants. If the great looks are any indication of what to expect in the air, then the flight characteristics must be outstanding.

Specs: wingspan—72 in.; length—62 in.; wing area—1,480 sq. in.; weight—12 to 14 lb.; radio—4-channel w/6 servos.

Superkraft; distributed by Kangke USA (631) 274-3058; kangkeusa.com.com.

**PARKZONE  
CHARGE-  
AND-FLY  
PARK FLYERS**

From the folks who brought us the ever popular HobbyZone products—including the line of Firebirds—comes a brand-new line of park flyers! These ready-to-fly planes will combine innovative RC technology (like X-Port plug-n-play accessories and Mode Change Flight Control) with park-flyer performance. All ParkZone aircraft come with a transmitter, batteries, a rechargeable battery pack and a DC peak-detect field charger, and they can be flight-ready in less time than it takes to charge the battery pack. Whether you're an experienced RC pilot looking for a fun, easy park-flyer fix or a HobbyZone fan who's ready for the next level of performance, ParkZone is sure to please.

ParkZone is launching the line with three aircraft: the J-3 Cub park flyer and F27 Stryker high-performance flying wing are shown here; stay tuned for a photo and info on the Slo-V indoor/outdoor slow flyer.

ParkZone; distributed by Horizon Hobby Distributors (800) 338-4639; (217) 355-9511; horizonhobby.com.

**SKYSHARK RC  
ME 109E KIT**

Skyshark RC's new, all-wood, 1/6-scale Messerschmitt Me 109E is CAD-designed and features high-quality laser-cut parts, full-color plans, photo-illustrated instruction manual, vinyl decals (four color schemes), scale cockpit kit and an aluminum spinner. All formed parts (engine cowl, vents, radiators, etc.) are made

of fiberglass. The 65-inch-span Me 109E weighs 7 to 9 pounds and is intended for .60 2-stroke and .60 to .90 4-stroke engines. Priced at \$289.95, the kit includes fixed landing gear (optional Spring Air 85-degree retracts are available). Skyshark RC (866) 854-6100; skysharkrc.com.

**HANGAR 9  
EDGE 540  
33% ARF**

Hangar 9 continues to develop its line of impressive giant-scale aerobatic ARFs with a brand-new, 33-percent scale Edge 540. With a wingspan of 97 inches, 1,730.6

**SHOWSTOPPER**

square inches of wing area and weighing only 23 pounds, the Edge 540 is ideal for the Zenoah GT-80 twin-cylinder engine. Considering how much airplane you get for your money, the \$849.99 price tag is a steal!

Hangar 9; distributed by Horizon Hobby Inc. (217) 355-9511; horizonhobby.com.

**TECH  
BREAKTHROUGH****HOBBICO  
ACCU-CYCLE  
PRO SERIES  
ELITE**

With all the exciting possibilities afforded by new battery technology, it's absolutely essential to have a versatile and reliable charger in your field equipment. Hobbico's redesigned Accu-Cycle is an excel-

lent choice. It charges, discharges and cycles any 1- to 10-cell Ni-Cd and NiMH, or 1- to 3-cell Li-poly pack up to five times. It has twin outputs for charging both halves of your radio system, and it features an Auto Smart Set that calculates safe time-out, charge rate, trickle rate and discharge voltage cutoff from just the battery type, capacity and voltage. You can program it with 10-memory presets if you want to store a favorite charge routine. Current ranges are from 50mA to 2 amps, and the unit is compatible with both AC and DC power sources.

Hobbico; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; hobbico.com.

**ROBART MFG.  
F-8  
CRUSADER  
II ARF**

Scale looks and a trainer to boot—what more could a wannabe jet jock ask for? This super-slippery design is remi-

niscient of the famous Navy fighter of the '60s and is sure to turn heads wherever it goes. It's designed around the FunSonic FS52AS turbine that produces up to 12 pounds of thrust. The kit contains all the little goodies you've come to expect from Robart. Specs: wingspan—60 in.; length—65 in.; weight—18 lb.; turbine engine with 12 lb. of thrust. Price not available at presstime.

Robart Mfg. (630) 584-7616; robart.com.



## TUFFLIGHT MODELS TUFFLIGHT 4D

Looking for the ultimate 3D aerobat? Then the new TuffFlight 4D is what you've been waiting for. The wing is constructed of EPP foam, and the tail feathers are made of Coroplast, so the 4D is virtually indestructible. Full flying-tail surfaces give outstanding control for all 3D moves.

Available in standard and deluxe kits, the 4D uses no balsa and can be assembled quickly.

Specifications: wingspan—48 in.; wing area—720 sq. in.; engine req'd—.30 to .46 2-stroke or .72 4-stroke; prices—\$74 (standard kit); \$104 (deluxe kit).

TuffFlight Models (315) 698-8103; [tufflight.com](http://tufflight.com).



## SAITO FA-82A ENGINE

Saito knows how to get the most out of a 4-stroke engine, and the Saito FA-82a demonstrates that perfectly. By using a single-piece cylinder-head casting, it can squeeze 0.82ci out of a .72 case.

That translates into 20 percent more power without additional weight. Who wouldn't want that? And of course, you

get Saito's legendary reliability and convenience, excellent fuel economy and that cool 4-stroke sound. If you have a .40 to .60 airplane that deserves something special in the nose, check out the FA-82a.

Saito; distributed by Horizon Hobby Distributors (800) 338-4639; [horizonhobby.com](http://horizonhobby.com).

## MRC REFLEX XTR

With panoramic scenery, detailed models and realistic flight characteristics, this simulator may be the next best thing to being at the field! The XTR features scenes created from photos of real flying fields with realistic shadows, light definition and surfaces—like tall grass—that interact with your sim model in the same way as they would at the flying field. XTR offers fixed-wing planes, trainers, helicopters, gliders and indoor flyers and allows you to create your own models. It requires a PC with 256MB RAM and 1GB available on your hard drive.

MRC (732) 225-6360; [modelrectifier.com](http://modelrectifier.com).



## TECH BREAKTHROUGH



## SIG MFG. SUN DANCER BIPE ARF

More than a pretty face, the new Sun Dancer ARF is a great IMAA-legal aerobatic biplane with clean and classic sport looks! With a 72-inch span and 1,702 square inches of wing area, it can use from 1.60 2-stroke glow engines up to 3.2ci gas powerplants. Featuring high-quality balsa and ply construction and covered with Oracover film, the Sun Dancer will give those Pitts and Ultimate bipes a run for their money!

Sig Mfg. (641) 623-5154; [sigmfg.com](http://sigmfg.com).

## SHOWSTOPPER

## FALCON TRADING CO. BEAVER ON FLOATS

Ready for some great summer flying at your favorite lake? If you are, the new Beaver



on Floats is what you're looking for. The floatplane has an airfoiled fin and stab and corrugated ailerons. Blow-molded floats and strong plastic landing gear will make this beauty your favorite floatplane! Specs: wingspan—61.75 in.; length—48 in.; wing area—604 sq. in.; weight—6

lb. 6 oz.; engine—.46 2-stroke or .52 4-stroke. Price not available at presstime.

Falcon Trading Co. (219) 942-1134; [falcon-trading.com](http://falcon-trading.com).

## JET HANGAR HOBBIES F4D SKYRAY

A copy of a wind-tunnel test model, this new little Skyray is electric powered and can be fitted with mini Jet Hangar Hobbies retracts. Designed to use 69- to 90mm fan units, the prototype is powered by a 480 brushless motor.

Jet Hangar Hobbies (562) 467-0260; [jethangar.com](http://jethangar.com).



## LANIER RC RAZOR 3D ARF

With its oversize control surfaces, airfoil tail surfaces and split-elevator bellcrank system, the new Razor 3D ARF provides excellent 3D flight performance. Loops, 4- and 8-point rolls, harriers, waterfalls and blenders; it does everything! Its all-wood airframe permits easy and accurate assembly, and the fiberglass cowl, wheel pants and aluminum landing gear speed building time. Specs: wingspan—52 in.; wing area—560 sq. in.; overall length—54 in.; recommended engine size—.40 to .50 2-stroke and .48 to .70 4-stroke; flying weight—4.5 to 5 lb; price—\$204.99.

Lanier RC (770) 532-6401; [lanierrc.com](http://lanierrc.com).

## SUMMER FAVORITE





### AEROWORKS 27% ULTIMATE 10-300 ARF

A smaller version of the winning Tournament of Champions 42% Ultimate, this 50cc-size Ultimate is sure to be a favorite at the flying field. With a 50cc

engine and a flying weight of only 14 pounds, the performance is truly unlimited. The model features an airfoiled removable tail section, removable 2-piece wings and no flying wires for quick field assembly. Specs: wingspan—63 in.; length—63 in.; wing area—1,420 sq. in.; 50cc gas engine; price—\$595.95.

Aeroworks (303) 366-4205; [aero-works.net](http://aero-works.net).

### HORIZON HOBBY EVOLUTION .36NT

We love the philosophy behind the Evolution line of engines from Horizon: no break-in, no tuning, no hassle—just bolt it on and go! The latest is the .36NT, and it features a .806-inch bore, a .695-inch stroke and weighs about 12.4 ounces (with the included muffler). It is optimized for a 9x6 prop. Like other Evolution engines, the .36NT has SetRight preset needle valves, a ball-bearing-supported crank shaft and a canted glow plug. These features make it ideally suited to beginners, as does the low \$79.99 price tag. Horizon Hobby Inc. (800) 338-4639; [horizonhobby.com](http://horizonhobby.com).



### CERMARK E-3D BANCHEE

This unlimited freestyle design can do it all: torque rolls, blenders, harriers, rolling circles ... you name it! It features all-wood construction, purple or green UltraCote covering and factory-painted parts. Add a 4-channel RC system with four miniservos and a Speed 600-size brushless motor, and you'll be set to impress. It costs just \$150.95.

Cermark (562) 906-0808; [cermark.com](http://cermark.com).



### WILDCAT FUEL NEW LOOK!

The Wildcat line of high-quality aircraft fuels is sporting a brand-new look, but as always, the new labels provide all fuel-content information, including the oil percentage and type—in case you want to know what's in your fuel (and you should!). Wildcat has a fuel to fit any application: the all-synthetic 2- and 4-Cycle Blends work equally well with 2- and 4-stroke engines; Premium and Premium Xtra feature a cas-

tor/synthetic-oil blend; Helimix keeps helicopter engines running right; ProMix is ideal for high-performance aircraft; and Jet-A is specifically designed for use with ducted-fan engines.

Wildcat Fuel (888) 815-7575 (orders); (859) 885-5619; [wildcatfuel.com](http://wildcatfuel.com).



### ASTROFLIGHT MODEL 200 FIREFLY ESC AND 840 GEARED MOTOR

Two great new products for electric planes are now available from AstroFlight. The new Astro Model 200 Firefly high-frequency speed control uses a digital microprocessor to control the motor speed for a silky-smooth operation. The new Astro 840 geared motor will swing a 14-, 15- and 16-inch prop, so it's great for midsize models. Model 200 speed controller specifications: maximum no. of cells—10, Li-poly 2 to 3; maximum and continuous current—4 amps; weight—7g. 840 geared motor specifications: rpm—5,200 to 8,600; maximum no. of cells—24, Li-poly 6; diameter—1.35 in.; length—2.5 in.; weight—8.9 oz. (with gearbox, 11 oz.).

AstroFlight Inc. (310) 821-6242; [astroflight.com](http://astroflight.com).



### WATTAGE CESSNA AIRMASTER 165

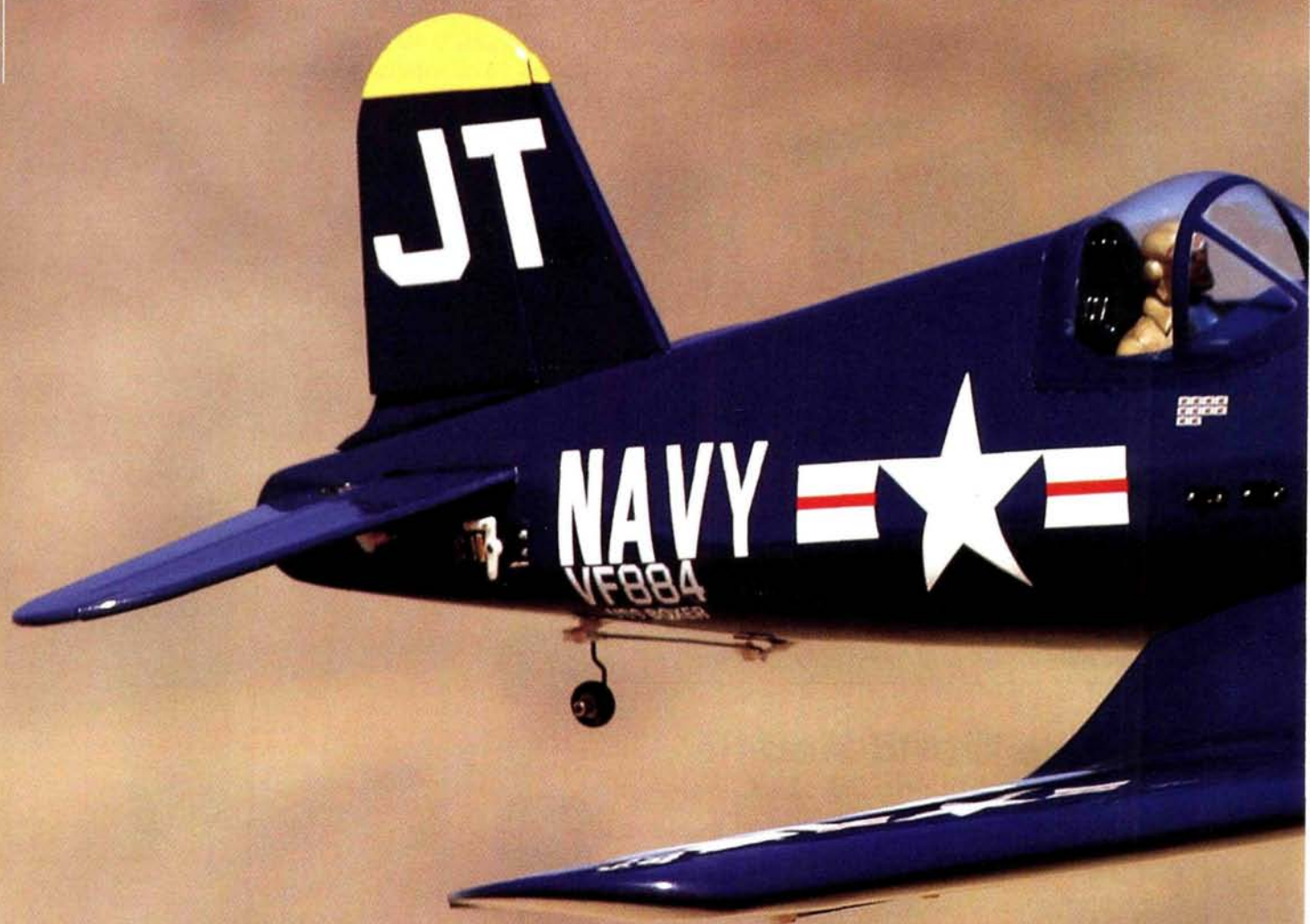
With its classic good looks and great flight performance, this ARF park flyer is hard to resist. It features a molded-plastic fuselage with fully built-up balsa wings and tail that are covered with iron-on film. With a 370 geared motor in its nose, the Airmaster can handle all 3-channel aerobatics and has plenty of power. Cost? Just \$94.95! Specs: wingspan—30.5 in.; length—24.75 in.; wing area—170 sq. in.; weight—16.25 to 17 oz.; motor req'd—geared 370; radio req'd—3-channel w/2 microservos.

WattAge; distributed by Global Hobby Distributors (800) 854-8471; (714) 963-0133; [globalhobby.com](http://globalhobby.com).



SUMMER  
FAVORITE

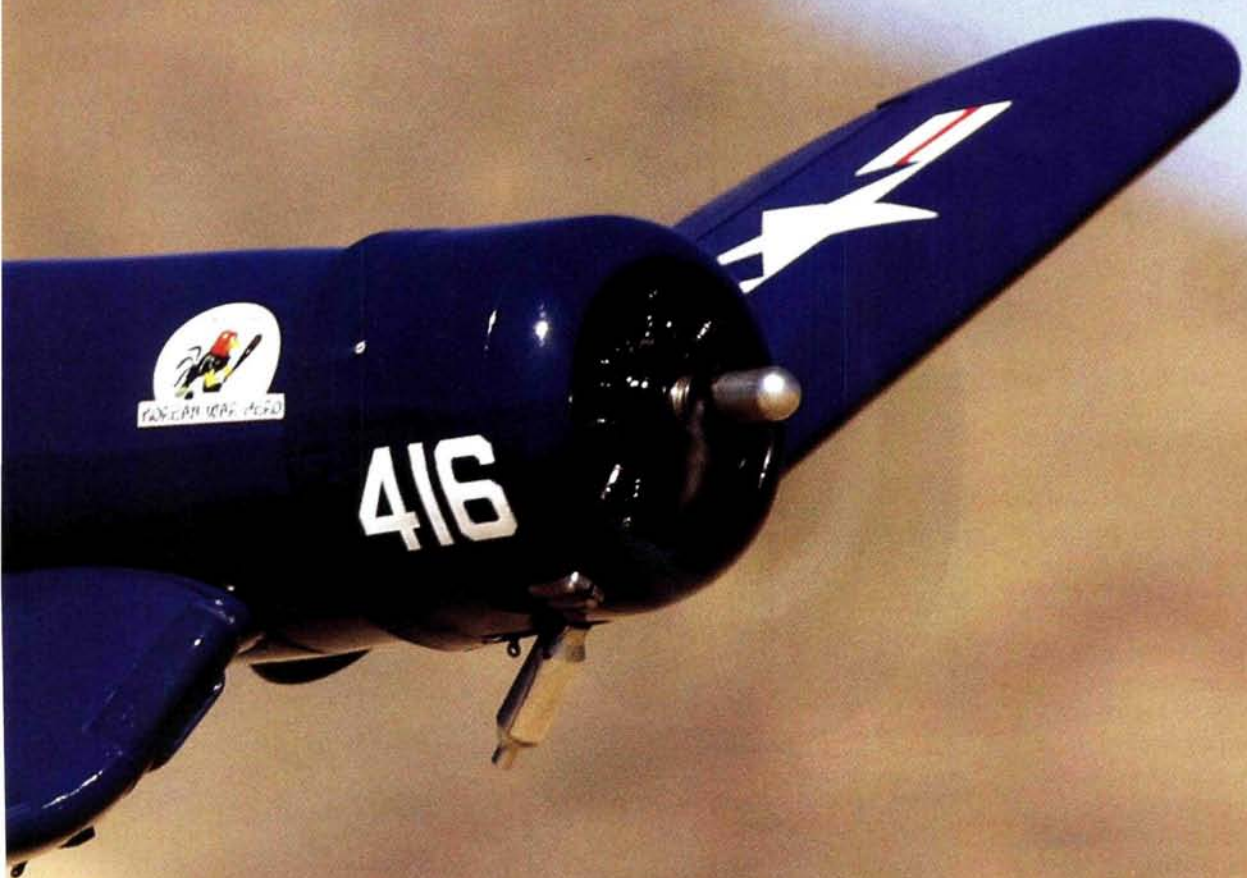




**H**angar 9's .60-size Corsair is perfect; it's large enough to be visible in the air, small enough to be easily transported and replete with scale details such as a decked-out cockpit, a clear canopy, a painted fiberglass cowl, a molded dummy radial engine and wing radiators. When you also consider the 90-degree retracts that come installed in the wings and ready to be hooked up, it's clear that Hangar 9 has another winner!

Constructed of balsa and plywood and covered with UltraCote, the Corsair features a three-piece wing and tail feathers that are slotted for CA hinges. A fuel tank, engine mount, tailwheel, main wheels and a complete hardware package round out the package. As you might expect with a Hangar 9 plane, the manual is concise and has easy-to-follow instructions and excellent illustrations. You need only add a .61 to .75 2-stroke or a .91 to 1.00 4-stroke engine, a 5-channel radio system and radio gear and, of course, a pilot figure.





HANGAR 9

by Tom Carter

# Corsair

*The bent-wing devil*





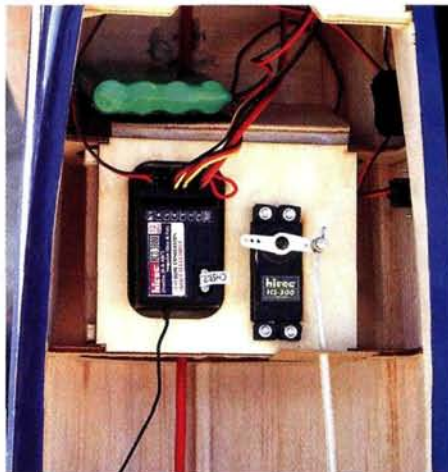
• **Wing assembly.** I started by checking the fit of the CA hinges in the ailerons and cleaning the hinge slots before I glued the hinges in place. The servo hatches were already cut out, so I needed only to glue into place the hardwood blocks for the servo mounts. I used Hangar 9 30-minute epoxy on the blocks to ensure a good bond.

To ensure that I had a good bond, I let the epoxy set for two hours before I installed the servos. I installed a Hitec HS-425BB servo for each aileron and hooked up one aileron servo to the 24-inch Y-harness, using masking tape to secure the connection so the wires wouldn't pull away from each other. With one half connected, I test-fit my wing joiner and made sure that it moved freely on both wing halves and the wing center section. Before I applied epoxy to the wing joiner, I marked it with a pen at the midpoint. I brushed epoxy onto the joiner, the wing root and the center section; I secured them with masking tape while the epoxy cured. I cut out the retract box with a hobby knife and slid the aileron Y-harness up through it. I then hooked up the other aileron servo to the Y-harness and put epoxy on the other joiner, the wing root and the center section, and I slid them together for a tight bond. Make sure that the retract pushrods are free when you slide the wing halves together. Let both joints cure completely before you mount the retract servo.

I used a Hitec HS-75BB and the red heavy-duty arm for the retract servo. These retracts are very good but must be adjusted correctly for smooth operation, and they will have to be adjusted in three directions. After installing the retract servo, I followed the testing guidelines in the manual, and with a little adjusting, the retracts worked fine. Next, I installed the wheel



**Above:** the engine is mounted using adjustable motor mounts—very nice for adjusting the distance from the engine to the firewall. **Below:** the spacious fuselage allows plenty of room to work.



wells in the wing, and to prevent any possibility of hang-up, I made sure that the retract mechanism didn't touch the wheel wells. Once the retracts were in and working, I installed the control horns on the ailerons and then fitted, tested and adjusted the aileron-servo controls.

#### ENGINE INSTALLATION

I chose a Magnum .91 4-stroke with a 3-blade prop to get this bird flying. This combination has worked well for me on

## specifications

**MODEL:** F4U Corsair .60 ARF

**MANUFACTURER:** Hangar 9

**DISTRIBUTOR:** Horizon Hobby Distributors

**TYPE:** scale warbird

**WINGSPAN:** 65.25 in.

**WING AREA:** 752 sq. in.

**LENGTH:** 51.5 in.

**WEIGHT:** 8.5 lb.

**WING LOADING:** 26 oz./sq. ft.

**ENGINE REQ'D:** .61 to .75 2-stroke, .91 to 1.0 4-stroke

**ENGINE USED:** Magnum .91 4-stroke

**RADIO REQ'D:** 5-channel w/6 servos

**RADIO USED:** Airtronics RD6000 with Hitec RCD 3800 receiver, 5 HS-425BB Hitec servos and 1 HS-75BB Hitec retract servo

**PROP USED:**  
3-blade, 13x8  
Master Airscrew

**FUEL USED:**  
PowerMaster  
15% nitro

**PRICE:** \$264.99



**FEATURES:** built-up construction; UltraCote covering; complete hardware package that includes a fiberglass cowl with dummy radial engine and wing radiators. The kit also includes a canopy, a detailed cockpit, decals and an illustrated manual.

**COMMENTS:** this well-done kit is a breeze to build and fly. Its construction is of high quality all the way; well-written instructions guide you step by step. I really enjoyed building this kit, and when I flew it, I knew I had a winner that I would fly for a long time.

#### HITS

- Very complete manual.
- Easy to track when airborne.
- Easy to assemble quickly.

#### MISSES

- None.

planes weighing up to 9½ pounds. This engine fits very nicely and provides plenty of power. Using the supplied adjustable engine mounts, I didn't have any problems setting the engine at the proper angle. Unlike most engine setups, the offset is set with the engine tilted upward a few degrees. The manufacturer assured me that this is correct, and it is set up this way because of the plane's gull wing. I then drilled the opening for the pushrod throttle and connected it to the servo.



# Bent-wing legend

A peanut—that's what you feel like after you've scaled the side of a Corsair and climbed into the cockpit. You are so small and inconsequential compared to the airplane that you feel like a peanut. This thing is *big* and intimidating! If looks could kill, then you wouldn't even have to fire it up to become an ace.

With 2,800ci of fire-breathing Pratt & Whitney perched on the end of that impossibly long nose and three of Mr. Browning's fast-firing specials in each wing, the Corsair more than looked mean; it *was* mean. And, it was tough.

As legendary as the Corsair became in the hands of heroes like Pappy Boyington, the Corsair was far from an instant success. It actually was an instant flop as a carrier plane. The Navy refused to qualify it for carrier duty until December 1944—two years after its introduction—because it demonstrated too many shortcomings. For one thing, that big nose blotted out everything directly ahead, and the canopy bulged upward so the pilot could position himself in the cockpit for landings. The airplane exhibited a really nasty rolling tendency when it stalled, so a large, fierce-looking wedge was added to the right wing to help control the airflow.

The airplane also loved to bounce on touch-down. Carrier airplanes can't bounce. They are supposed to hit the deck and stick. But the Corsair bounced—a lot. The fix for that was a single-action, landing-gear leg that absorbed shock but didn't feed any of the energy back into the airplane. Considering that the gear already had a linkage that not only rotated the wheels to fair them into the wing but also made the gear shorter so it would fit better, designing a no-bounce shock system into it was a pretty

good feat. But they did it, and eventually, the Corsair became a double threat: it could launch from island runways and carriers alike.

The early Corsairs, the F4U-1A and FG-1As, suspended the pilot in a metal chair many feet above the fuselage's cavernous belly. If you

that the Zero rolled like a turtle when flying fast. Although the Corsair wasn't an exact match for the Zero in a turning fight, in the right hands, it could hold its own. As soon as the combat moved into a vertical format, however, the Corsair shone, as it could slash and dash



dropped anything smaller than a basketball down that yawning hole, it was gone. As the Corsair matured, it became more sophisticated. It grew floorboards, and the canopy could be moved forward and backward with the flick of a switch. It was also continually upgraded with ever-increasing power; the last wartime version, the F4U-4, was to have 2,450 ponies stuffed into that cowl.

Surprisingly, the airplane has nice, slick controls with a higher roll rate than you'd expect. That ability to roll didn't disappear during a dive; this was a huge advantage considering

with the best of them. It would drop down on its foe like an avenging angel, only to zoom up and do it again. Plus, the Corsair could absorb immense punishment and still bring its pilot home.

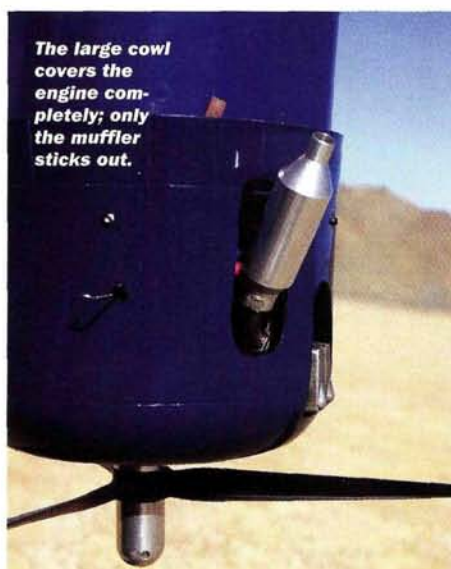
One of the most distinctive airplanes of WW II, this was also the only one to stay in long-term production after the War. In 1953, after 13 years of continuous production, the last Corsair rolled off the line as an AU-1 ground-attack machine for the USMC.

Old Hose Nose earned, and is deserving of, its legendary status. —Budd Davisson

This was very easy because the throttle servo is the only one in the fuselage, so positioning it is a breeze. The dummy radial engine fits the cowl nicely. Before I applied the epoxy, I roughened the inside of the cowl so the epoxy would bond better, and I spread the epoxy on the inner lip of the cowl. Using paper, I made a pattern of the cowl cutouts required for the engine head, the exhaust and the needle valve. The cowl is fitted on the blocks on the firewall. The directions for its installation were quite clear, and the final cowl fit is great.

## TAIL INSTALLATION

I trimmed the UltraCote covering away from the section of the fin that slides into the fuselage slot, and then I inserted it



**The large cowl covers the engine completely; only the muffer sticks out.**

into the slot and made sure that it fit. I did the same with the stabilizer, and I was careful not to cut into the wood. I applied 30-minute epoxy to the uncovered stabilizer wood and installed it so it was aligned properly with the fuselage. I checked its alignment using a string tied to the centerline at the front of the fuselage. When both stabilizer tips were the same distance from the front of the fuselage, I used pins to hold the stabilizer in place. I removed the excess epoxy with alcohol. When I did the same with the rudder, I made sure that it was aligned at 90 degrees to the stabilizer. I positioned the tailwheel wire and slid the control horn down on it; I locked the control horn down and then slid the top of the tailwheel wire up through the fuselage.



**TAKEOFF AND LANDING**

Add a little left rudder, and the plane tracks beautifully. After about 30 feet, the tail rises gently; give it a little up-elevator, and it's airborne. The Corsair has a nice, gentle climbout and is very stable. With the gear down for a slow flyby, I had to throttle up a little to compensate for the drag of the retracts.

On landing, I make a shallow descent and ease back to a medium idle. Just before landing, I flare out, and the wheels gently touch down on the runway.

**LOW-SPEED FLIGHT**

At low speed and on low rates, this plane is very responsive. I was able to stall it, and all it did was just drop its nose straight ahead; there wasn't any noticeable wing drop. For most of the flight, I flew it on  $\frac{1}{4}$  throttle without having any control problems.

**HIGH-SPEED PERFORMANCE**

At full throttle, this plane really moves! I highly recommend that you keep everything on low rates! This plane is very stable at full speed and has more than enough control at low rates.

**AEROBATICS**

The Corsair is not an aerobatic plane, but it will do a number of maneuvers, including a very stable roll, nice tracking inside loops, barrel rolls and snap rolls. It will fly inverted and requires a little down-elevator. I tried the same maneuvers on high rates and found that the response was then too sensitive for my taste.

I measured outward 1 inch from the top of the fuselage and carefully put a 90-degree bend in the tailwheel wire, making sure that the bend was  $\frac{3}{4}$  inch away from the fuselage. Then I drilled a hole in the rudder and slid it onto the tailwheel wire, making sure that it moved freely from left to right without binding. I used CA on the hinges and epoxy on the wire horn. I installed the rudder servo with a 12-inch extension in a hole in the bottom of the fuselage about 4 inches in front of the tailwheel. This servo activates the rudder from the tailwheel shaft.

A U-bend rod passes through the fuselage and is inserted into the two elevators. I measured carefully and then drilled holes in each elevator for this rod. I inserted the hinges into the stabilizer slots and put epoxy into the holes in the elevators. I inserted the hinges and the U-rod into the elevators, making sure that there was free movement in both directions. A few drops of CA on both sides of the hinges held everything in place until the epoxy cured. I installed the elevator servo just under the stabilizer's leading edge; the servo wire also required a 12-inch extension. I was worried about both servos being installed at the rear of the fuselage, but I didn't have any problems balancing the plane. In fact, I did not have to add any counterweight.

• **Final details.** I wrapped foam rubber around the fuel tank and slid it into place. The receiver fits right into the mounting tray in the fuselage, and rubber bands hold it in place. I moved the battery around to balance the Corsair, and



To add to the plane's responsiveness, the kit incorporates short couplings from all the servos to the control surfaces.



Authentic-looking, isn't it? The dummy radial engine, 3-blade prop, wing air scoops and painted pilot all add to the plane's realism.

eventually installed it just below the wing's trailing edge. I installed the switch harness on the fuselage side away from the muffler and set all of the control throws to the manufacturer's recommendations.

**FIRST FLIGHT**

Before the first flight, I wanted to make sure that the retracts worked well without any problems; after cycling the gear up and down a few times, I was convinced that there wouldn't be any. The Magnum engine started right up, and after adjusting the carburetor, I was ready to practice taxiing. I was surprised by the Corsair's positive control response when on the ground. After just a minute or two, I was ready for takeoff.

**FINAL VERDICT**

The Hangar 9 F4U Corsair is a real beauty and attracts lots of attention at the field. Its great flight performance and solid control response make its handling almost like that of an advanced trainer. If you are in the market for a scale warbird, you'll have a hard time finding a better one than this. Check out the Hangar 9 F4U Corsair the next time you're in the hobby shop; I'm sure you'll be impressed. ✦

Airtronics (714) 978-1895; [airtronics.net](http://airtronics.net).

Hangar 9; distributed by Horizon Hobby Inc. (800) 338-4639; [horizonhobby.com](http://horizonhobby.com).

Hitec RCD Inc. (858) 748-6948; [hitecrd.com](http://hitecrd.com).

Magnum; distributed by Global Hobby Distributors (714) 963-0329; [globalhobby.net](http://globalhobby.net).

Master Airscrew; distributed by Windsor Propeller Co. (916) 631-8385; [masterairscrew.com](http://masterairscrew.com).

PowerMaster Hobby Products Inc. (512) 285-9595; [powermasterfuels.com](http://powermasterfuels.com).









by Craig Trachten

# GREAT PLANES Venus

*Out-of-this-world aerobat*

# 40





**T**he Venus 40 is a testament to Great Planes' commitment to producing top-shelf aircraft. This glow-powered, almost-ready-to-fly (ARF) sport model is a terrific aerobat that's beautifully covered in multicolored MonoKote. Add to this what is probably the best documentation in the industry, and you end up with a great-looking, easy-building airplane that will be among the finest flyers in your air force.







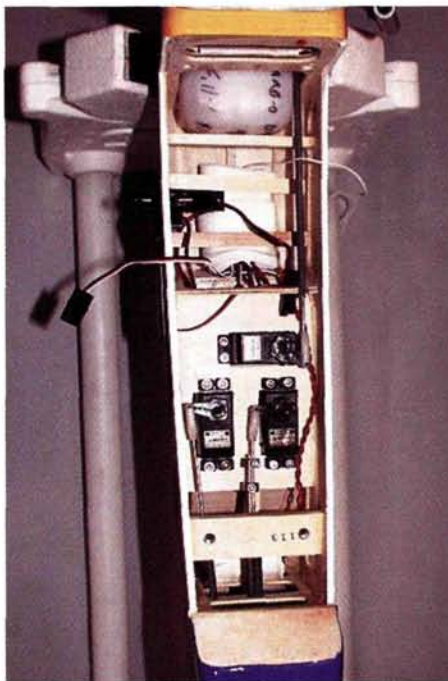
### ASSEMBLY

• **Wing.** Construction begins with the installation of the ailerons in the wing halves. The supplied sheet of CA hinge material must be cut into individual hinges, so I put it aside for a later date. Instead, I used Great Planes' precut CA hinges; they're easier and faster to attach. The sheet material can be better used elsewhere, such as to reinforce the cowl.

Open the holes in the bottom of each wing half for the servo and servo-lead exit. To prevent the MonoKote from lifting, seal the edges of the opening with your covering iron. Secure the servos to the wing, and pull the leads through the exit holes. Once you've attached the horns and pushrods as illustrated in the instructions, you'll be ready to join the wing halves.

Trial-fit the wing joiner in both halves. It should slide in tightly but should not bind. If necessary, sand it to fit. At this point, I attached my "epoxy ooze guard" (a piece of 3/4-inch masking tape) to the root of each wing half. When the halves are joined, the ooze ends up on the tape—not on the wing covering. When you remove the tape after the epoxy has set, the mess goes with it.

• **Wing mounting.** Start by inspecting the factory-installed blind nuts. Apply a little epoxy around them to ensure that they stay put. Cut away the MonoKote that's covering the wing-bolt holes. Test-fit the wing to make sure that it's aligned (open the mounting holes, if necessary). Measure and then mount the wing-bolt plate to the wing. When you remove the covering to mount the plate, cut it so that the plate will cover its edges. Attach the wing to the fuselage, and put the belly pan in its proper position. Trace the pan on the wing, and cut and remove the covering from that area. Using 30-minute epoxy, secure the pan to the wing.



The radio compartment provides plenty of room to work on your radio gear.

• **Tail surfaces.** Remove the covering over the slot for the horizontal-stab and pushrod exits. Seal these areas with your iron to prevent the MonoKote from lifting. Slide the stab through the slot, center it and mark where to remove the covering when you epoxy it. Remove the covering on the stab just where it goes into the fuselage so that the edges won't be exposed. Make sure that the horizontal stab is parallel to the wing, and then epoxy it into place.

Assemble the tailwheel and secure it to the fuselage. Mark the rudder where the tailwheel wire will be inserted, and drill a 3/32-inch-diameter hole 1 1/4 inches deep. Use a Great Planes Groove Tube tool, a sharpened 3/32-inch piece of brass tube, or do what I do: cut a V-shaped groove in the rudder with a hobby knife to make a

## specifications

**MODEL:** Venus 40 ARF

**MANUFACTURER:** Great Planes Model Manufacturing Co.

**TYPE:** aerobatic sport

**LENGTH:** 54 in.

**WINGSPAN:** 55 in.

**WING AREA:** 568 sq. in.

**WEIGHT:** 5 lb.

**WING LOADING:**

20 1/4 oz./sq. ft.

**ENGINE REQ'D:** .40 to  
.51 2-stroke or .52 to  
.70 4-stroke

**ENGINE USED:** O.S. .46FX

**PROP:** APC 11x6

**RADIO REQ'D:** 4-channel  
w/5 servos [elevator,  
throttle, rudder,  
ailerons (2)]

**RADIO USED:** Futaba 8UAPS

**FUEL:** Wildcat 15%

**PRICE:** \$159.99

**FEATURES:** painted fiberglass cowl and wheel pants; multicolored MonoKote covering; balsa and ply construction; fully symmetrical, double-tapered wing; clear molded canopy; photo-illustrated manual; complete hardware package.

**COMMENTS:** the Venus 40 is a keeper! It's a really nice sport aerobatic airplane that takes little effort to assemble. Its flight characteristics are solid and forgiving, and its multicolored MonoKote trim scheme makes it a standout whether it's on the flightline or in the air. Overall, it's one of the finest models I have had the pleasure of flying.

### HITS

- Multicolored MonoKote covering.
- Painted fiberglass cowl and wheel pants.
- Excellent instructions.

### MISSSES

- None.

recess for the tailwheel wire. Using your CA hinges, attach the elevator and rudder to the aircraft.

• **Engine/tank installation.** The first step here, of course, is to choose your engine. My favorite 2-stroke engine is—hands-down—the O.S. .46FX, so that's what I chose for this aircraft. Cut out the mounting template in the back of the instruction manual, and use it to mark the mounting holes on the firewall. Secure the mount to the firewall with the supplied hardware.



### TAKEOFF AND LANDING

Because I was using an old, reliable engine, run-up consisted only of adjusting the high-speed needle for the conditions of the day. I took a few high-speed taxis down the runway to get a feel for the aircraft, and as it showed no tendency to ground loop, I punched it—off I went! After climbing to altitude, I trimmed for straight and level flight at  $\frac{1}{2}$  throttle. I took a few passes and then brought it in. On final, it needed only throttle to control altitude, and I greased the landing.

### SLOW-SPEED FLIGHT

The Venus 40's performance was phenomenal. On low rates, this aircraft can be a low-wing trainer. When it stalled, the nose dropped without breaking to the right or left. Add throttle and a little up-elevator, and you're off—straight and level. It flies comfortably at low speeds.

### HIGH-SPEED FLIGHT

This is where the airplane is in its element. The response to inputs is crisp and accurate; it goes where you put it. At high speed, I couldn't stall the aircraft; all it did was climb. When I throttled back in a climb, the aircraft fell off slightly to the left, and the nose dropped. Add throttle, and you're back in control.

### AEROBATICS

You just hit the lottery! This plane is a keeper—a must-have! (Can you tell that I like this aircraft?) The Venus 40 will make you look like a better pilot than you are—at least, that's

what it did for me. Inverted flight takes nothing more than flipping the aircraft onto its back and resting your finger on down-elevator. If you choose to trim for inverted flight, it takes only two clicks of down-elevator for hands-off inverted flight. Knife-edge flight required nothing more than putting the aircraft on edge and then holding rudder for altitude. Horizon to horizon, knife-edge was parallel to the flightline without elevator input. Not being a precision aerobatic flier, I just tried to rip the wings off the Venus. Couldn't be done! No matter how I jammed and threw the sticks, I'd let them go to neutral, count to "1" and be back in control.



Note: the instructions that came with the review model contained a typographical error concerning where to position the drive washer; a "Tech Note" on the Great Planes website addresses and corrects this. It states that the drive washer should be positioned  $4\frac{1}{2}$  inches in front of the firewall—not  $4\frac{15}{16}$  inches. After you've marked the positions of the mounting holes, drill them and then mount your engine. Based on the location of the carburetor on whichever engine you use, mark and drill a hole in the firewall for the throttle control rod.

The Venus is one of a few kits that uses a 3-line fuel-tank system—always a good idea. I have long made it a practice to use one with cowed aircraft. Although the instructions didn't advise it, I installed a fuel tube and a clunk to the third line in the tank. With the clunked third line, you will be able to empty your airplane's fuel tank without having to stand it on its beak. I also use three fuel lines of different colors and write the color code for the carb, vent and fill lines on the tank, so I know which line is which.

- **Radio/pushrod installation.** Check which side your throttle servo needs to be on, and then epoxy or CA the servo tray into place. The instructions show a clevis being used on the throttle rod, but I prefer a ball and cup. My throttle pushrod needed a few bends, and I find that a ball and



**The O.S. .46 FX engine is an ideal power source for the Venus 40. The drive washer should be  $4\frac{1}{2}$  inches from the firewall.**

cup allow the pushrod to do its job without binding. I installed the rest of the pushrods using the supplied clevises and quick links. The radio compartment has plenty of room for the receiver; I installed it in the front and the receiver battery in the back. I mounted the wing, checked the aircraft's center of gravity (CG) on my Great Planes CG Machine and determined that the battery belonged in back.

- **Cowl mounting.** This is probably my least favorite part of the building process, but it's necessary for a good-looking aircraft. As far as cowls go, this one is fairly easy to install and yields a clean-looking result.

Begin by marking the mounting position on the fuselage and taping long strips

of stiff paper (such as card stock) so that they extend over the parts of the cowl that need holes or trimming, e.g., muffler-opening, needle-valve-extension, carb-clearance and cooling holes. Attach the cowl and transfer the cut marks to it. I apply a little thin CA around the openings to help prevent the fiberglass from fraying. Since I had installed a 3-line tank, I used a Rocket City fuel dot for a clean look and easy fueling.

### FINISHING TOUCHES

Install the landing gear and secure the canopy. A pilot bust is a nice finishing touch. I yanked one from a retired aircraft in my hangar. Apply the decals and check the control throws, and you'll be ready for the flight of your life! ✈

**APC Props;** distributed by Landing Products (530) 661-0399; [apcprop.com](http://apcprop.com).

**Futaba Corp. of America;** distributed by Great Planes Model Distributors; [futaba-rc.com](http://futaba-rc.com).

**Great Planes Model Mfg. Co.;** distributed by Great Planes Model Distributors.

**Great Planes Model Distributors** (217) 398-6300; (800) 682-8948; [greatplanes.com](http://greatplanes.com).

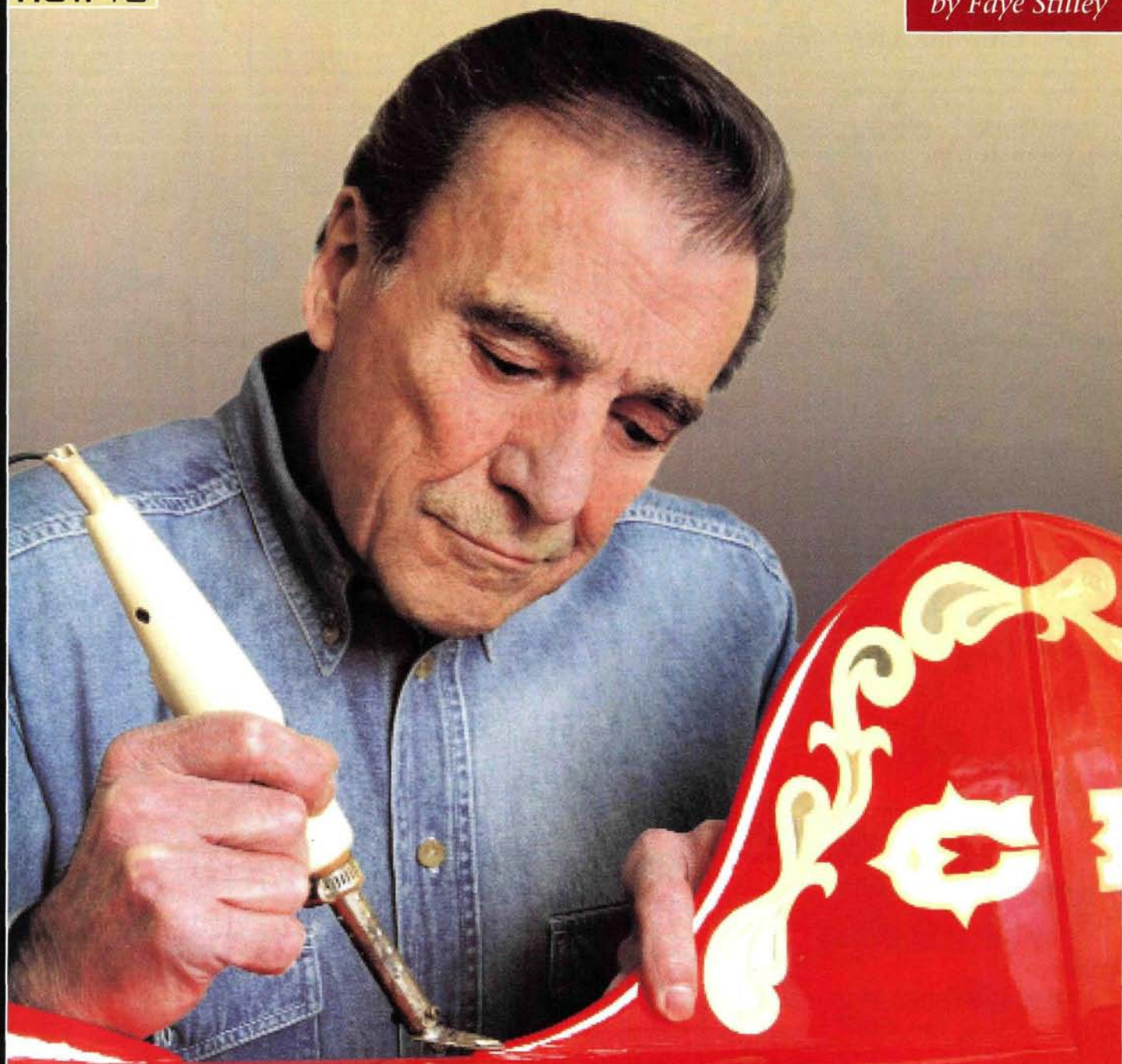
**MonoKote;** distributed by Great Planes Model Distributors.

**O.S. Engines;** distributed by Great Planes Model Distributors; [osengines.com](http://osengines.com).

**Rocket City R/C Specialties** (205) 539-8358.

**Wildcat Fuels** (859) 885-5619; orders only (888) 815-7575; [wildcatfuel.com](http://wildcatfuel.com).





# Create Multicolored Graphics

*An easy technique for iron-on covering*

Multicolored graphics greatly enhance the appearance of RC airplanes, but if you simply iron on small pieces, you may soon wipe them off as you clean your plane. Sealing small pieces under the larger graphic provides a secure, fuelproof finish. I'm using a graphic that has five small inserts to illus-

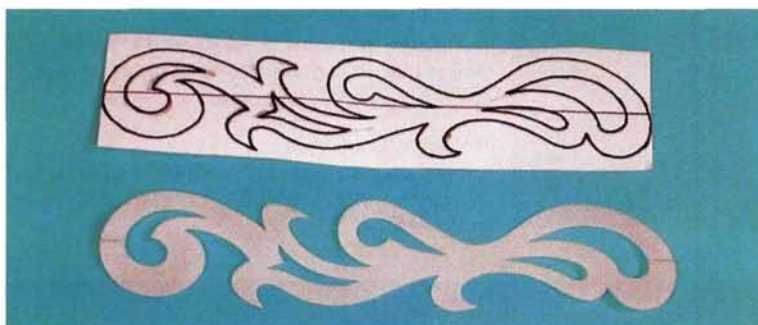
trate the technique. You may never make a graphic such as this, but you can use this same technique to apply letters, squadron emblems, stars, bars, or anything that uses multiple colors. I used MonoKote for this design, but this technique will apply to most iron-on plastic coverings.





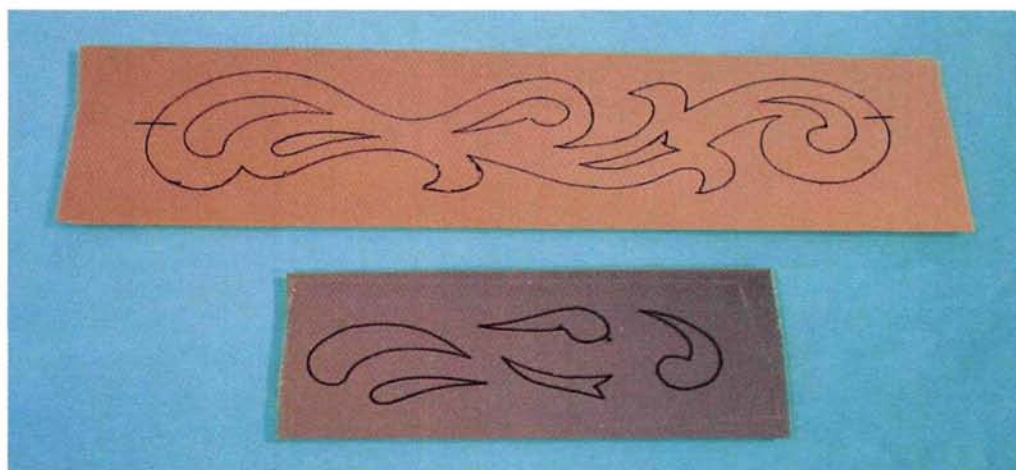
Faye won "Best MonoKote" for this outstanding finish at this year's Toledo Week Signals RC Exposition.

**1** Draw the desired graphic, or find a drawing or photograph that you would like to put on your plane. Use a copier to reduce or enlarge the image to the appropriate size. To prepare a template, trace the image onto transparent material. Mylar sheets work well for templates; you can buy them at art- and drafting-supply stores. If you plan to use the template several times, use a heavier material like See-Temp; it's specifically designed for making templates. Make reference marks on the template to help you position the graphic on the airplane. Note that drawings tend to be fairly rough. You can smooth out the lines when you cut out the template. Hobby knives work better than scissors because they allow you to accurately cut the inside patterns.



**3** Cut out the large graphic and the smaller inserts using a hobby knife with a new, very sharp no. 11 blade. Then lift the covering material off the glass with a dull blade. Note that I cut the larger graphic on the lines but the smaller ones about  $\frac{1}{16}$  inch outside the lines. I did this so that I would have enough material for good adhesion under the larger piece. Don't remove the lines on the smaller pieces until after you've finished assembling the graphic because it makes it easier to position the smaller pieces under the larger one.

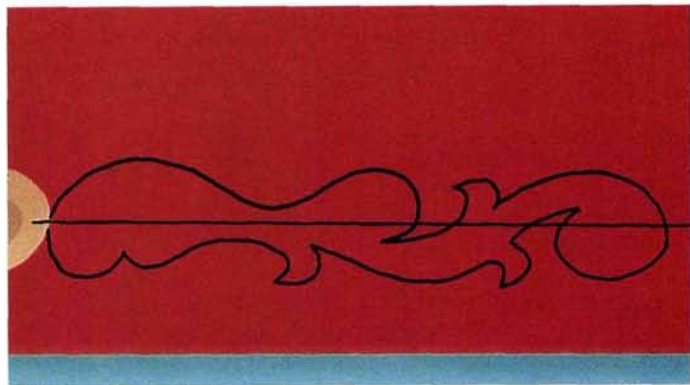
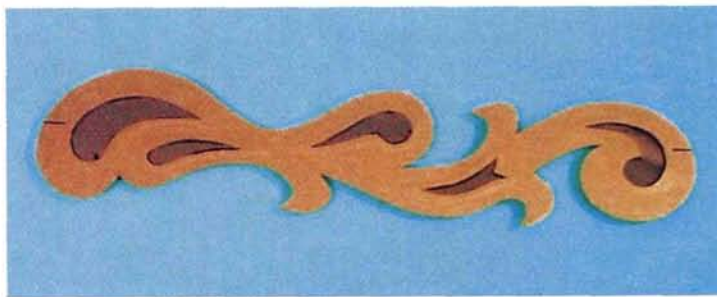
**2** Remove the backing and rub the covering material onto a piece of wet glass (this holds the material in place so that you can make intricate cuts). I use a  $\frac{1}{4}$ -inch-thick piece of tempered glass. Remove all of the water bubbles from underneath the covering with a rubber squeegee. You can buy a small squeegee at an auto parts store, but any piece of firm rubber will work as long as it doesn't scratch the covering material. Draw the outlines for both the larger graphic and the smaller inserts.





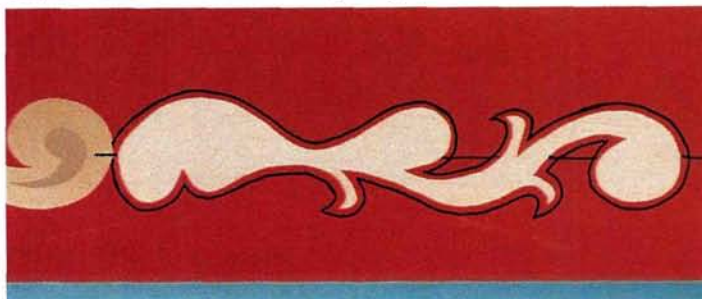
## HOW TO: CREATE MULTICOLORED GRAPHICS

**4** Before you assemble the graphic, put a piece of the covering material's backing (barely visible in the photo) onto the piece of glass. This will prevent the covering material from sticking to the glass as you iron the graphic together. Put the small pieces under the larger one and iron them into place one at a time. A pencil with its eraser sharpened to a point is an excellent tool for positioning the smaller pieces. The correct temperature for the iron will vary according to the type of covering material. It should be low—just hot enough to make the covering stick to itself. This temperature will usually be less than that needed to attach the covering to wood. When the inserts are all in place, lift the backing off the glass and gently peel away the graphic.



**5** Using the template again, draw the outline of the graphic on the airplane. The reference lines really help during this step. I use a Sanford Sharpie ultra-fine-line marker because the ink can be wiped off easily with alcohol after everything is in place.

**6** Cut and remove the covering from the area where the graphic will be placed. Leave at least an  $\frac{1}{8}$ -inch border inside the graphic outline to create a fuelproof seam that doesn't have bubbles. Before making the cut, put a new blade in your hobby knife. If your blade isn't extremely sharp, you may use too much pressure and cut into the underlying wood. It's OK if you scratch the wood slightly as you cut; the scratches will be sealed by the graphic and won't be visible.



**7** I've ironed the finished graphic into place, and I wiped the ink off with alcohol. For final sealing, increase your iron's temperature; experiment (not with the material that's on the airplane) to find the proper temperature that will seal the graphic permanently without creating any bubbles. Make a note of the two iron temperatures that you used with the covering material.

I'm sure that you'll be so pleased with the results that you will want to do many more multi-colored graphics in the future. ✚

See *Temp*; [seetemp.com](http://seetemp.com).

*MonoKote*; distributed by Great Planes Model Distributor (217) 398-6300; (800) 682-8948; [greatplanes.com](http://greatplanes.com).









ICARE

# DG-800S

*Cutting-edge scale glider*







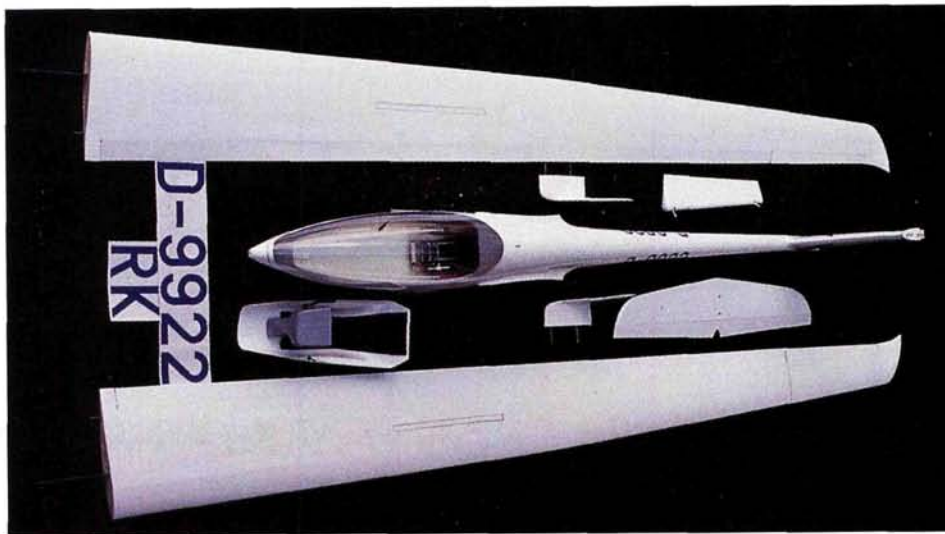
by Sal Iasilli



**T**he full-size DG-800S sailplane is manufactured in Germany by Glaser-Dirks (now DG Flugzeugbau), and its wing design is state of the art for a racing glider. It can be flown in either the 15-meter or the 18-meter class by adding wing-panel extensions, or "winglets." Its highly successful competition record, especially in Europe, speaks for itself.

The DG-800S model is a composite replica of the full-scale racing sailplane. It comes with two wing lengths just like its full-size counterpart: a 138-inch wing with large fiberglass, plug-in winglets represents the 15-meter class, and a 165-inch wing with plug-in extension wing panels and mini fiberglass winglets represents the 18-meter class. This new breed of model sailplane is classified as "super scale," which means that it incorporates many scale features not ordinarily found in almost-ready-to fly (ARF) models, such as a fabric-padded cockpit tray, a molded-fiberglass mushroom instrument console, side levers, a communication microphone, a front-hinged canopy with locking mechanism, sliding side-vent window, a fitted and painted canopy frame, a tailwheel, retractable landing gear and fully applied graphics.





• **Basic construction.** The fiberglass fuselage is finished in gleaming white gelcoat and has the elevator and rudder control tubes with inner wires already epoxied into place. The wings are made of white foam with full-length carbon-fiber-reinforced spruce spars; they are sheeted with fiberglass cloth, sandwiched with balsa and covered with white film. Steel wing blades come installed in each wing panel, so the wings are easily mounted on the fuselage. Nylon bolts are used to mount the stab on the fin. The ailerons and flaps are also hinged in the covering process. The rudder, elevator and stab are also made of foam and covered with balsa and film. The double-deck spoilers are factory installed. Cutouts for the ailerons, flaps and spoiler servos are provided.

• **Radio installation.** The scale cockpit tray that holds a full-length pilot figure takes up most of the forward cockpit area. This makes it necessary to mount the rudder, elevator and retract servos at the rear of the tray. The receiver is mounted just below and forward of the servos, and a 1500mAh battery pack sits just in front of the receiver. I soldered threaded brass couplers to the provided music wire going to the servos and control surfaces along with Du-Bro Kwik-Links. Hitec's HS-81MG metal gear servos mounted on the outer wing panels activate the ailerons and also the spoilers, and HS-225MGs

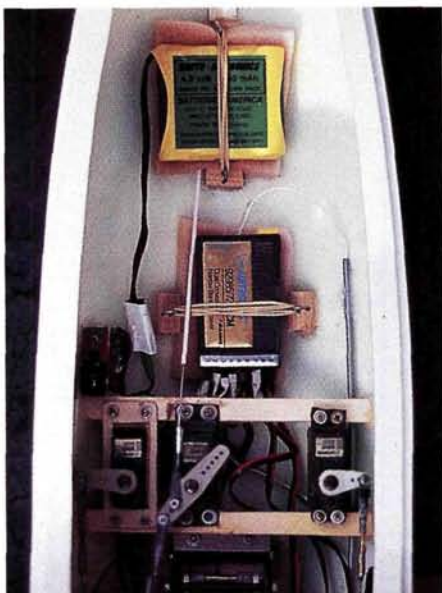
were used for the flaps. The rudder and elevator servos are Airtronics 141s. The retract servo is Airtronics' standard, heavy-duty servo that also activates the aero-tow release mechanism.

• **Scale finishing touches.** The DG canopy/cockpit is so large that it requires a full-body pilot figure. I used the 1/4-scale glider pilot from Icare; it is very light and looks realistic. The scale instruments are from Hobby Lobby. All the DG graphics are factory applied, with the exception of those for the lower wing; apply those after you have installed the servos.

#### PREFLIGHT SETUP

It took approximately 4 ounces of lead in the nose to balance the model at the recommended CG. A red arrow on each fuselage side indicates the proper location. I programmed my radio for 25 degrees up and 12 degrees down ailerons, 35 degrees right

and left rudder, 15 degrees up- and down-elevator, 45 degrees down flaps with 10 degrees elevator compensation mixed in, 3 to 4 degrees down wing camber (flaps and ailerons) for thermalling, and 1 to 2 degrees up wing reflex (flaps and ailerons) for high-speed flight. For winch launching, I mounted one towhook on each side of the fuselage, 1 inch below each wing and 3/8 inch forward of the CG. This arrangement requires a bridle



The radio box is cavernous; there is ample room for the servos, battery and receiver.

## specifications

**MODEL:** DG-800S Super Scale ARF

**MANUFACTURER:** K.V. Models

**DISTRIBUTOR:** Icare

**TYPE:** ARF 1/4.3 scale sailplane

**WINGSPAN:** 138 in. or 165 in.

**WING AREA:** 1,044 sq. in. to 1,172 sq. in.

**WEIGHT:** 7 to 7.5 lb.

**WING LOADING:** 13.7 to 14.7 oz./sq. ft.

**AIRFOIL:** HQ2.5/14

**RADIO REQ'D:** 7- to 8-channel with 7 servos (ailerons, flaps, elevator, rudder, spoiler, retracts and tow release)

**RADIO USED:** Airtronics Vision PCM with Hitec and Airtronics servos

**PRICE:** \$769

**FEATURES:** gelcoated fiberglass fuselage; completely finished composite fiberglass, wood and foam wings; balsa-sheeted foam stab, elevator and rudder; retractable landing gear, spoilers, hinged and fitted canopy and factory-installed graphics.

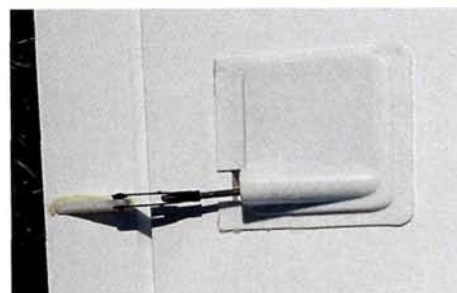
**COMMENTS:** the DG-800S is not only a great-looking scale sailplane, but its ability to ride the lightest of thermals is truly a plus as well.

#### HITS

- Excellent part-to-part fit.
- Very good scale outline accuracy.
- Flight performance is much better than that of most scale sailplanes this size.

#### MISSES

- No instruction manual provided.
- No hardware package.



Above: the Graupner servo covers for the ailerons and flaps are molded ABS and are available through Hobby Lobby. Below: the double-deck spoilers are extremely effective when descending from high altitude.







### TAKEOFFS AND LANDINGS

I initiated the maiden flight using an aero-tow. A 100-foot tow line was attached to the DG's tow wire in the lower part of the forward fuselage. The towplane was a 1/4-scale L-19 Birdog powered by a Saito 300 4-stroke. With the glider and the towplane pointed into the wind and the DG's flaps set at 20 degrees, we were airborne in less than 50 feet—the glider, of course, several seconds before the towplane. Takeoff was straight and true, just as with the full-scale sailplane.

At approximately 1,500 feet altitude, while the towplane and glider were still visible, I activated the retract switch on the transmitter and released the tow line. The DG lets you know when it encounters thermal activity (lift): its nose rises slightly and the wings sway from side to side. This slight disturbance in its flight path tells you to start circling. I am happy to report that the first flight lasted a delightful 30 minutes.

For landing, I used a combination of spoilers and flaps. The

double-deck spoilers are very effective for descending from great heights, especially when you are trying to come down from a strong thermal that has taken you a bit too high. Flaps are also very effective for slowing the model on final approach prior to touchdown.

### SLOW-SPEED PERFORMANCE

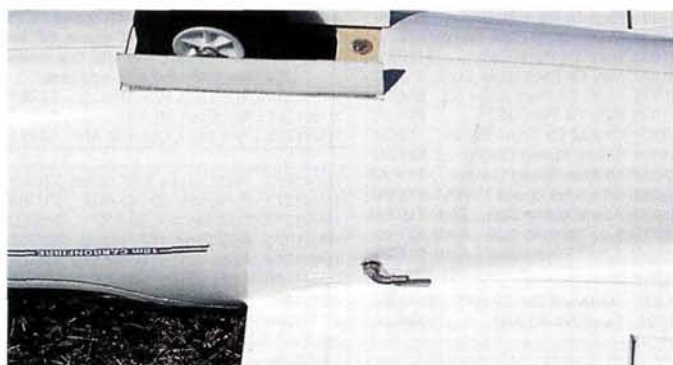
When circling in thermal activity, especially weak ones, the DG can be slowed down quite a bit with the use of wing camber without the fear of stalling. If the glider falls out of the thermal or slows down too much, you will experience a mild stall that is easily corrected when you apply some down-elevator to regain controllable airspeed.

### HIGH-SPEED PERFORMANCE

To achieve high speed, I thermal to high altitude, reflex the ailerons and flaps at 2 degrees up and apply down-elevator. The DG turns into a bird of prey in its downward dive with a high-pitched whistling during its descent. It's quite impressive to see and hear, and spectators always enjoy this performance.

### AEROBATICS

Flying this model with the short wing configuration and the ailerons switched to the high-rate settings lets you do maneuvers such as axial rolls, hammerhead turns, loops, split-S's and even Cuban-8s. To perform these maneuvers, it is crucial to have enough altitude and to start each from a dive to pick up adequate speed to successfully complete each aerobatic sequence. In Germany, sailplane aerobatics is becoming a very popular sport, and with capable models like the DG, it may catch on here in the States.



Above: the side towhook is installed below the wing, just in front of the indicated CG. Right: the hinged canopy with the supporting strut gives unrestricted access to the cockpit interior, but it requires a full pilot figure.

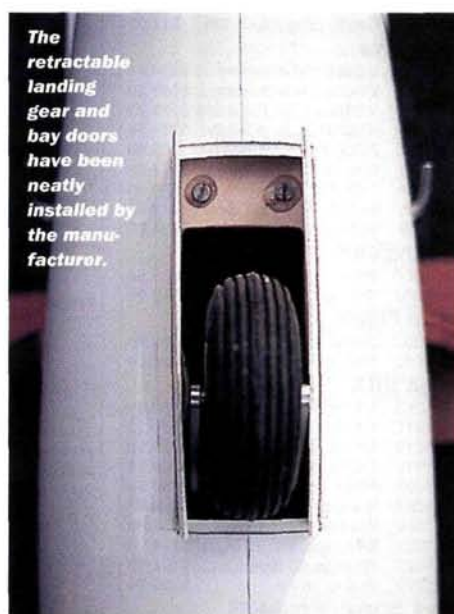


with an adjustable clevis quick link and attached it to the retract servo arm. I fitted the control-wire tubing under the cockpit tray and the battery pack. I then epoxy-glassed the end of the tubing to the forward cockpit floor just in front of the canopy tray. I cut a 1/16-inch slot through the tubing and a 3/8-inch slot through the fiberglass fuselage floor. The tow-line loop is then simply inserted through the floor cutout, and when the retract servo is in the down position, this activates the control

wire and captures the tow loop in the wire tubing setup. When the landing gear is in the up position, the retract servo will pull the wire back and release the tow loop that is attached to the tow line. This is a simple and very reliable tow-release setup.

### CONCLUSION

The DG-800S is everything you would want in a large-scale sailplane—beauty,



The retractable landing gear and bay doors have been neatly installed by the manufacturer.

high performance, versatility, affordability and, best of all, it's fun to fly. I highly recommend it to anyone who is looking to venture into the purity of silent flight. ✦

**Airtronics Inc.** (714) 978-1895; [airtronics.net](http://airtronics.net).

**Du-Bro Products** (800) 848-9411; [dubro.com](http://dubro.com).

**Graupner Models**; distributed by Hobby Lobby Intl.

**Hitec RCD Inc.** (858) 748-6948; [hitecrad.com](http://hitecrad.com).

**Hobby Lobby Intl.** (615) 373-1444;

[hobby-lobby.com](http://hobby-lobby.com).

**Icare Sailplanes** (450) 449-9094; [icare-rc.com](http://icare-rc.com).





**JR**  
**Venture**  
**50 3D ARF**

by Rick Bell

*The ultimate quick-build heli*





**T**he Venture 50 3D ARF is the latest addition to JR's growing helicopter line. It follows the same basic format as its smaller brother, the .30-size Venture CP. When designing the midsize 3D-capable heli, JR wisely decided to stick with a simple, proven format.

Following the current trend in helicopters, the Venture 50 uses a 3-servo, 120-degree cyclic/collective pitch mixing system (CCPM) and a belt-driven tail rotor. These two features and a low parts count exemplify the Venture's simplicity. And in its almost-ready-to-fly (ARF) format, the Venture 50 can be completed in an afternoon. When the guys at JR say this heli is an ARF, they aren't kidding!







### WHAT YOU GET

When you open its large box, the Venture already looks like a helicopter. This is an encouraging sight for those who have never built a helicopter; it removes the "How am I ever going to put this together?" factor. The main rotor head comes completely assembled, and it features an aluminum center hub, two ball bearings and thrust bearings to support the heavy-duty feathering shaft, 3D dampers and the blade grips; all of these were designed to handle the rigors of hammering 3D aerobatics.

The chassis is the same as the one on the Venture 30 except that it uses a longer tail boom to accommodate the required 600mm main blades. The tail boom supports are stronger to withstand the stresses of 3D aerobatics. The heli also sports a new, sleeker canopy design. The fuel tank holds 320cc (10.8 ounces) of fuel and is mounted forward of the engine. This seems a little small for a .50-size engine, and JR addresses this by including a 2-ounce header tank in the kit. This is a first, as no other heli manufacturer offers a header tank as standard equipment.

The kit also includes a durable plastic canopy that's trimmed and installed on the chassis. Curiously, though, the windshield needs to be trimmed and screwed to the canopy. The decals are very colorful and provide good orientation during aerobatics. The included manual is one of the best in the business, and it's worth reading before starting the assembly. It explains how to build the heli (what little there is), what CCPM is and how it works. It also explains how to install and set up the radio with parameters for basic and 3D flight modes for four models of JR radios (XP662, X-378, XP8103 and PCM10X). The manual is simple, so if you've never dealt with CCPM, or if this is your first heli, you'll be able to follow the



*The included header tank not only increases flight time, but it's also a visible fuel gauge.*



*Before I installed the tail fins on the model, I applied the decals to them; it's easier this way.*



*The horizontal stab mount is an integral part of the boom supports and adds a lot of strength.*

instructions with little fuss. The kit also includes heavy-duty servo arms for JR servos, a longer 3D flybar and paddles.

### ASSEMBLY NOTES

As mentioned, there isn't much to do when assembling the Venture 50 3D; the

## specifications

**MODEL:** Venture 50 3D ARF

**MANUFACTURER:** JR

**DISTRIBUTOR:** Horizon Hobby Inc.

**TYPE:** .50-size aerobatic helicopter

**MAIN ROTOR DIAMETER:** 52.63 in.

**LENGTH:** 47.32 in.

**WEIGHT:** 7.25 lb.

**RADIO SYSTEM REQ'D:**

5-channel heli w/120-deg. CCPM mixing

**RADIO SYSTEM USED:**

JR 10X transmitter, 3 JR DS8231 digital servos (collective, roll and pitch cyclic), 1 JR PS8700G high-speed servo (rudder), 1 JR NES4131 servo (throttle) and a JR 460T gyro

**ENGINE REQ'D:**

.50 2-stroke heli

**ENGINE USED:**

O.S. 50SX-H

**FUEL USED:** Wildcat

30% heli blend

**PRICE:** \$349.99

**FEATURES:** ARF format; simple CCPM control system; aerobatic main rotor head; high-quality swashplate; one-way hex start shaft; belt-driven tail rotor; ball bearings throughout; low parts count; self-aligning steel clutch; header tank; includes optional 3D parts.

**COMMENTS:** JR's Venture 50 3D is a one-size-fits-all helicopter. If you're a beginner, you'll appreciate the comprehensive manual and minimal assembly required. Intermediate pilots looking to increase their aerobatic skills are covered, too. The Venture 50 is a great 3D trainer. And for expert pilots, the Venture 50 is a low-cost heli that can be used to polish your 3D routine. Try one; you'll see what I mean!

### HITS

- Minimal assembly required.
- Concise instructions.
- Versatile performance.

### MISSES

- None.

instructions cover the assembly process quite nicely. So instead of going through it step by step, I'll cover the areas that aren't so obvious.

Because I knew that assembly would proceed rapidly, I first rounded up the components so they would be readily available. The tail boom requires only that it



To make the first flights easier, I broke in the O.S. 50SX-H on the bench. This allowed me to get the carb closely dialed in and made it easier to start the engine. For fuel, I used Wildcat 30 percent hell fuel and a set of Northern Helicopter Products (NHP) 600mm carbon-fiber blades with great results. Before flying the Venture, I dialed in pitch and throttle curves for normal and aerobatic flight modes.

#### GENERAL FLIGHT CHARACTERISTICS

The Venture 50 is a nice, midsize heli that I enjoyed flying from the very start. During the first liftoff, a slight blade-tracking adjustment was needed to bring the blades into alignment. This indicates that the factory-set pushrod lengths were very close. After that, slight adjustments to the hovering and pitch curves were needed to suit my requirements. This resulted in a very stable, rock-solid hover. The cyclic response is very positive and quick.

After a few tanks of fuel had been run through the Venture, it was time to fly; the Venture showed a lot of agility. Basic aerobatics such as loops and rolls were very uneventful. Fast-forward flight didn't show any tendencies to pitch up or down.

#### AEROBATICS

Aggressive aerobatics were next on the list, and the model took it all in stride. The tail held well during backward flight and during pirouetting maneuvers. A 3D pitch curve of -9 degrees to +9 degrees suited the heli nicely. Tumbling and flipping maneuvers were effortless, as were other 3D-type maneuvers—a sign of powerful, well-balanced cyclic controls. The heli felt very comfortable with a head speed of around 1800rpm. The Venture 50 is a user-friendly heli that inspires confidence.



be plugged into the chassis and secured; the tail rotor assembly, drive belt, horizontal stab mount and boom supports are factory installed. Even the nuts and bolts that clamp the chassis around the tail boom have been installed.

Before installation, be sure to twist the drive belt 90 degrees clockwise (when looking at it from the front) before you slip it over the drive pulley. The boom supports are attached to the chassis, and

engine and servos. I told you there wasn't much to do!

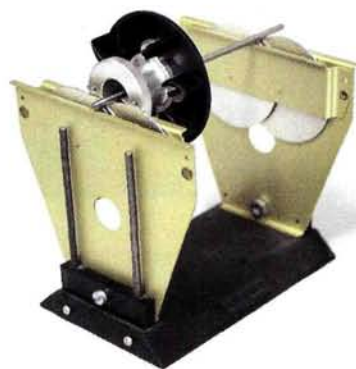
- **Engine and fuel system.** To power the Venture, I used an O.S. 50SX-H ringed engine. The engine is screwed to a cast-aluminum mount that is then secured across the chassis with the engine head toward the rear; this provides easy access to the glow plug. Before installing the engine in the chassis, I dial indicated the

Before the fuel tank (which has already been installed) and the engine can be plumbed, the 2-ounce header tank needs to be installed; it's simply bolted to the left side of the chassis. Adding the header tank to the fuel system is easy; the feed line from the tank goes to the upper nipple on the header tank, and the feed line from the header tank goes to the carburetor. Muffler pressure pushes fuel from the main tank to the header tank. Besides increasing the fuel quantity on board, the header tank improves engine performance and consistency and provides an easy way to see how much fuel is left.

- **Radio installation.** The swashplate requires 3 servos to drive it, and these all must be the same. I used JR DS8231 digitals because of their precise control and excellent power. The servos are mounted within the chassis; I routed their leads inside the chassis as well. After the servos have been installed, the manual becomes your best friend; it provides detailed instructions on how to set up the CCPM system. If you're using a JR radio, choose the pages that apply to your radio and follow the instructions to the letter; you can't go wrong.

The chassis has a molded-in battery compartment under the front of the receiver-mounting tray. I wrapped my receiver battery in foam rubber and placed it in the compartment. I also wrapped the receiver in foam rubber and placed it on the mounting tray. The tray has a bunch of molded-in lugs so that you can wrap rubber bands around them to hold the radio equipment in place—a very smart setup.

For those who haven't dealt with a CCPM setup before, here are some pointers to get you started:



**Left:** four guides support the tail-rotor pushrod. They wrap around the boom, and a single screw secures the ends. **Right:** for a smooth-running heli, all rotating parts should be balanced. Here, the cooling fan is being checked out on a Robart High Point balancer.

the boom is pulled back to tighten the drive belt. The tail fins are attached to their mounts, and I applied the decals to them before installing them. I installed the tail-rotor pushrod next, and I sanded it so that it would slide more easily in the boom-mounted pushrod guides.

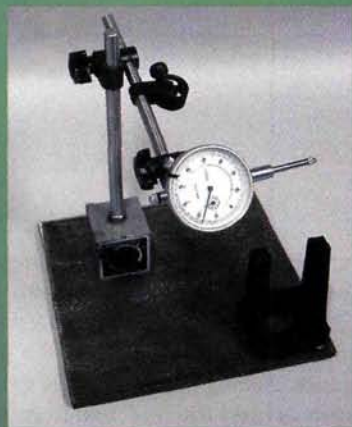
Before you snap the ball link on the tail rotor bellcrank, take a few minutes and adjust the pushrod so that it will move with the least amount of resistance. That completes the mechanical assembly of the heli except for the installation of the

cooling fan and clutch assembly (see the "All shook up" sidebar for details on this important step). After the engine/cooling-fan/clutch-assembly is dialed in, the engine and the engine mount slides into the chassis after the carburetor is removed. JR must have changed the mount after the instructions were written. The pictures show 3x30mm bolts and locknuts being used to secure the engine to the mount, when in fact, 3x12mm bolts are used; the engine mount has been threaded for the shorter bolts.



## All shook up

The key to a smooth-operating helicopter is balancing the rotating parts such as the cooling fan, clutch bell, main gear and the rotor blades and using a dial indicator to check the runout (out-of-true condition) of the cooling fan, clutch and start shaft. Balancing rotating parts is a complicated process and would take many pages to explain; instead, we'll look only at how to use a dial indicator; keep in mind that this is the method I use to check and adjust runout, but it's by no means the only way to do things.

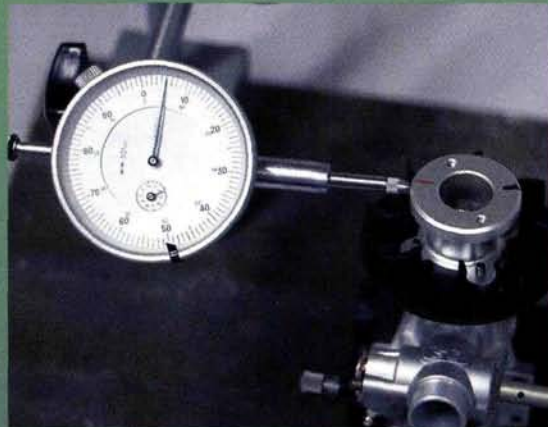


**Left:** here are the basic tools needed to check the runout: a heavy, stable metal plate, a dial indicator and a mount to securely hold the engine. **Right:** the cooling fan is checked first; it's only finger tight on the engine, so adjustments can easily be made. The runout should be less than 0.002 inch.

Why use a dial indicator? Isn't just securely fastening the parts to the engine good enough, especially if the fan uses a tapered collet? Not really; you must remember that the fan and clutch assembly are fastened directly to the engine's crankshaft and therefore are turning at the same rpm. This can be anywhere from 10,000 to 14,000rpm, or even greater. If the runout of these

assemblies is greater than 0.002 inch, the bearings and the radio equipment will very quickly fail due to excessive high-frequency vibrations.

Today, most helicopters use a brass tapered collet to center the fan on the engine, however, the Venture 50 doesn't, so the need to check the runout can't be overlooked. Checking runout isn't very difficult, and you need only a few tools. Obviously you need a dial indicator that reads in the thousandths, and you need a way to secure the engine. I use a heavy, solid-steel plate that's 9x9



and 3/8-inch thick so it doesn't move around. I then vertically mount a composite engine mount (to which the engine is bolted) to the plate. This simple and versatile method has served me well.

First, remove the glow plug (you want the engine to turn over easily), and then install the fan loosely (finger tight) on the engine using the prop nut. Secure the engine to the mount so it doesn't move;

it can be horizontal or vertical—whichever is more convenient. Position the dial indicator's pointer on the lip of the fan hub. Rotate the fan to find the high spot, and mark it with a felt-tip pen. Now, rotate the fan while watching the dial; if the runout is 0.002 inch or less, you can move on to the clutch. If it isn't, loosen the fan and rotate it 180 degrees; repeat the process and check the runout again. If the runout is less—great! If it isn't, return the fan to its original position and rotate it again, but only 90 degrees this time, and recheck the runout. Repeat this process until the runout comes in.

Once the runout is 0.002 inch or less, tighten the prop nut a little at a time, and check the runout after each tightening. If you apply too much torque, the fan could move. To make sure that the prop nut is fully tightened, remove the engine's backplate and use a wooden dowel or toothbrush handle placed between the housing and crankshaft to prevent the crank from rotating as you tighten the nut. Don't use a piston-locking tool to jam the crankshaft. These tools work by screwing into the glow-plug hole, and as you tighten the prop nut, the piston will be pushed against the end of the tool. I have seen people punch a hole in the top of the piston using this tool. Using a wooden dowel or toothbrush handle to jam the crankshaft is much safer.

To give you an idea of how easy it is to do all of this, my Venture took approximately 30 minutes to adjust the runout. After I balanced the fan (about 13 minutes), it took me about 17 minutes to check and adjust its runout. At first, the fan had a 0.005-inch runout. After I had moved things around a few times, the runout was 0.001 inch. The clutch runout was 0.004 inch; after I rotated it 180 degrees, it, too, was at 0.001 inch, and the start shaft was almost perfect. Not too bad for a few minutes of effort! Now if the heli has a high-frequency vibration, you'll know it isn't the fault of the engine assembly.

- All CCPM servos must be the same make and model.
- Initially, the travel adjust values (ATV) for the CCPM servos must be the same. If not, unwanted pitching and rolling of the swashplate will be created during collective pitch inputs.
- The throttle/collective stick and swashplate needs to be in the center of its travel during initial setup.
- The servo arms must be exactly horizontal. Minor adjustments can be made using subtrim to center the arms.
- All pick-up points on the servo arms must be the same distance from the center of the arm.
- The swashplate must be level fore/aft and left/right when the servo arms are centered. Adjust the swashplate pushrods to level the swashplate. Do not use sub-

trim; this will upset servo-arm centering.

Then follow the instructions for your particular radio to set up the pitch and throttle curves.

- **Final details.** All that is left is to trim the windshield, attach it to the canopy and apply the remaining decals. The cut lines on the windshield match the canopy very well, and four small screws secure the windshield. The canopy has molded in recesses where the muffler resides, so I decided to cut them out to provide cooling air for the muffler. I really like that the muffler is enclosed; it reduces the risk of burning yourself by touching it.

### IN CLOSING

The JR Venture 50 3D ARF is one impressive helicopter. Its aerobatic prowess is unmatched by any heli in the .50-size class,

and it's a logical step up from a .30-size heli. What little assembly there is goes quickly and easily thanks to the simple mechanical layout and tiny parts count. The icing on the cake, though, is the outstanding instruction manual; it goes far beyond most other heli manuals and isn't overly technical. Whether you're a novice, intermediate, or expert heli pilot, the Venture 50 3D gives you a lot of bang for your buck! ✦

**High Point;** distributed by Robart Mfg. (630) 584-7616; [robart.com](http://robart.com).

**Horizon Hobby Inc.** (800) 338-4639; [horizonhobby.com](http://horizonhobby.com).

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**Wildcat Fuels** (859) 885-5619; orders only (888) 815-7575; [wildcatfuel.com](http://wildcatfuel.com).









# Giant-Scale

*A 30-percent, precision classic*



**D**erived from the highly successful D.H. 60 Moth series of civilian aircraft that included the famous Gypsy Moth, the de Havilland D.H. 82A Tiger Moth is the quintessential British biplane trainer. The Tiger Moth has long been popular with modelers, and a cornucopia of "Tiggie" models is available today in the form of backyard flyers, ARFs, kits and plans. Few full-scale aircraft offer the available range of paint schemes (including military) from a dozen countries. Couple this with classic lines and docile flight characteristics, and the allure of this vintage biplane is easy to understand.

I flew a 1.20 glow-powered 1/4-scale Tiger Moth for many years and enjoyed the experience immensely. These days, my preferred power source is gas, and I wanted a model suitable for the Zenoah G-45. A 30-percent-scale version seemed perfect. I tried to keep its construction methods and field assembly as practical as I could without compromising scale fidelity; the only intended deviation from scale is a slight widening of the cowl nose to accommodate the G-45 fitted

with a Blisson Pitts-style muffler, a 90-degree carburetor bend and a 2-inch prop-drive extension. The plans show an absolutely scale cowl nose section for those who might use a narrower engine/muffler combo.

Many configurations of Tiger Moths are evident today, including all possible additions and omissions of retractable top-wing leading-edge slats, anti-spin strakes, navigation lights and a tailwheel as a tailskid substitute. My subject aircraft included all these extras, so they are also on the plans. There are, however, many attractive, easily documented examples of Tiger Moths that have none of these extras.

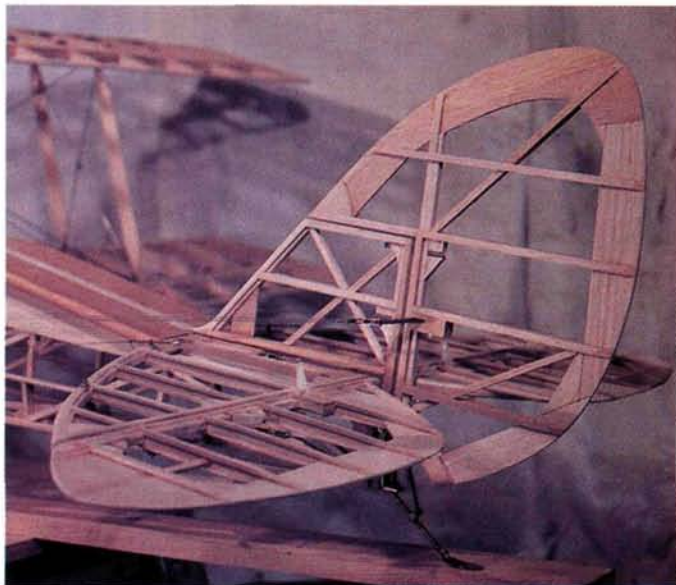
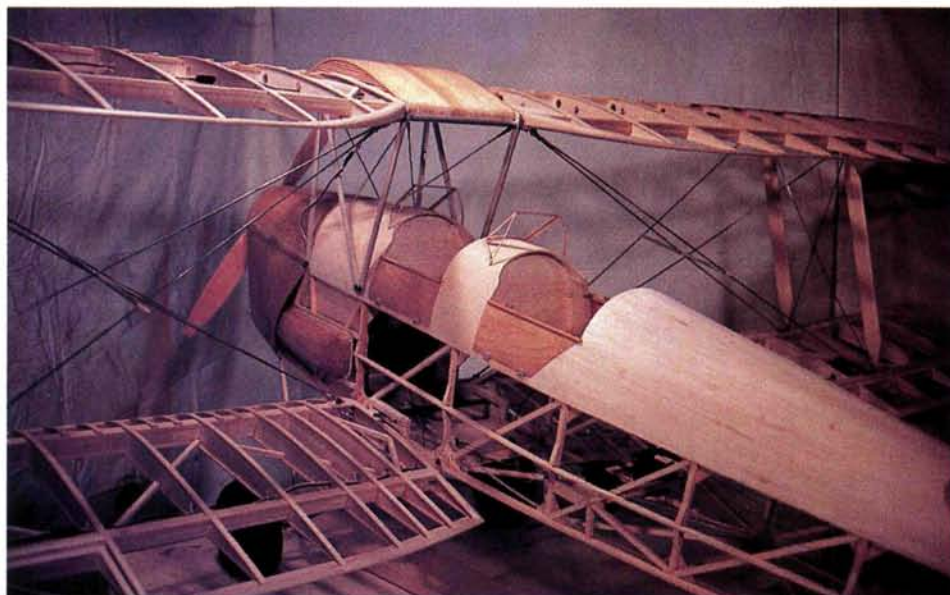
Detailed step-by-step construction notes are available on the *Model Airplane News* website "Click Trip," so I'll give only a general overview here. Construction materials consist of balsa, aircraft plywood, basswood, spruce, tubes of brass and aluminum and a multitude of small nuts, bolts and screws (all available from Micro Fasteners).



# Tiger Moth

by Gary Allen





**Top:** the Tiger Moth model construction closely follows the method used to build the full-size aircraft. It includes traditional use of balsa, plywood and lite-ply. **Center:** the engine cowl and the cabane struts and top wing center-section structure. **Bottom:** nothing complicated here. The tail surfaces are light and strong. Notice the filler blocks used around the Robert HingePoint hinges.

## specifications

**NAME:** 30%-scale Tiger Moth

**DESIGNER:** Gary Allen

**TYPE:** giant-scale biplane

**WINGSPAN:** 105.6 in.

**WING AREA:** 2,822 sq. in.

**FUSELAGE LENGTH:** 86.1 in.

**DRY WEIGHT:** 24 lb.

**WING LOADING:** 19.6 oz./sq. ft.

**ENGINE USED:** Zenoah G-45 with a Bisson Pitts-style muffler

**PROPELLER USED:** Moki 22x10

**RADIO REQ'D:** 4-channel (rudder, elevator, aileron, throttle)

## CONSTRUCTION

• **Fuselage.** The fuselage consists of four major subassemblies: the engine box, the upper-wing-tank center section, the landing gear and the main fuselage structure. The fuselage uses basic box construction and follows full-scale practice; spruce and balsa are substituted for the welded tubes of the original. The tank center section with its corrugated metal covering is one of the Tiger Moth's defining characteristics. It also represents probably the most tedious portion of construction. It is constructed around an  $\frac{1}{8}$ -inch-ply framework, which is sheeted and glassed with 2-ounce fiberglass cloth and epoxy resin. The corrugations are duplicated with half-rounded balsa strips, which I soaked in ammonia and very carefully glued to the tank structure. After I had sanded them smooth, I brushed three to four coats of thinned epoxy over the "corrugations." The results are very realistic.

I fabricated the cabane struts using  $\frac{1}{8}$ x $\frac{1}{2}$ -inch aluminum stock. The critical alignment of the center-section tank with the fuselage is achieved by working directly over the plans as you install the struts. Access to the rudder and throttle servos and the receiver and battery pack is through a hatch just behind the cowl. A bottom hatch just behind the cockpit provides access to the elevator servos.

The engine box is assembled out of  $\frac{1}{4}$ -inch-ply parts using epoxy and screws. It contains the tank mount and is attached to the fuselage with aluminum-angle stock, 6-32 socket-head bolts and blind nuts. The entire engine and tank assembly can be removed as a unit for servicing and access to the radio compartment. While the landing-gear outline and cross-sections are scale, their functionality is not. Shock absorption is provided by a traditional



## Documented "Tiggie"



The subject "Tiggie" aircraft was manufactured in 1947 and originally served with Station Flight RAF Church Fenton. It was acquired by the noted aerobatic pilot Jeremy Johnston and brought to North America when he emigrated to Canada. He retained the RAF No. 19 Squadron blue and white checkerboard markings by special permission. The aircraft was then sold to a New York resident, who flew it to the 1996 "Wings of Eagles" airshow held in Batavia, NY, where I photographed it.

*Decked out in traditional black and yellow trainer colors, this full-size Tiger Moth has a finish that's colorful yet simple to duplicate.*

## Tiger Moth: the world's primary trainer

The first time I strapped on a Tiger Moth, I had to laugh. For one thing, there was this huge compass projecting up off the floor between my knees. It was fashioned of polished brass and swung in gimbals to keep it level in all attitudes. It would have been more at home in a yacht.

My feet rested on a true rudder bar—a healthy-looking bar with a pad on both ends for my feet. A leather strap ran over the top of each foot, loosely trapping it in place. And there were no brake pedals. You set a lever for the amount of brake wanted, so pushing the rudder bar all the way down produced brake on that side.

Like the rest of the airplane, the Gypsy Major 1C up front (142 hp, 373ci) is an ancient 1920s design, and when it's kicked into life, the four short, inline stacks give it a vaguely Massey-Ferguson sound.

The little wooden doors that flip up and close over your shoulders are barely noticeable, and the view around the nose is actually not bad because you're so far back in the airplane and the fuselage is so narrow. Still, gentle S-turns are absolute necessities if you don't want to taxi into something the size of a fuel truck because it's stone blind straight ahead.

Takeoffs can best be described as "leisurely and civilized." The engine pop-pop-pops its way up to something like 1,800rpm, the airplane gently begins to move and then literally floats off the ground at a ridiculously slow speed. Compared with other aircraft, it feels as if you're moving at a fast walk. It also has a definite kite-like feel to it because it is so light and has so much wing area that there is no doubt it is flying on the wings, not the engine.

The brass-framed, faceted windshield holds most of the slipstream at bay, but just enough wind finds its way into the cockpit to ruffle your hair a little and remind you that you're in an open cockpit.

In the air, the word "leisurely" again pops into mind. The huge ailerons and light wing loading definitely remove the airplane from the Pitts category because even big aileron deflections don't result in big movements. The airplane is graceful in the extreme, but it wasn't born to be a dancer. Plus,

you're popping along at something less than 85mph, so the occasional ultralight will fly past you.

Landing the airplane is the ultimate in simplicity. A Tiger Moth has the drag coefficient of a parachute, so when the power is brought back on final, the nose is so far down to maintain speed that the runway remains firmly in sight. It's only when the ground gets big and you begin to rotate into that steeper-than-average three-point attitude that the runway disappears.

In the process of flaring to land, two things happen: first, the natural



background noise of the slipstream tripping over wires and struts changes tone. It gets lower and then slowly fades as the airplane settles onto the runway. Also, the airplane slows nearly to a stop while still in the air, and the impression is that you hovered to touchdown. It is all so veddy civilized. And so veddy British.

During WW II, we had the Stearman. The rest of the good guys, however, had the Tiger Moth. —Budd Davisson

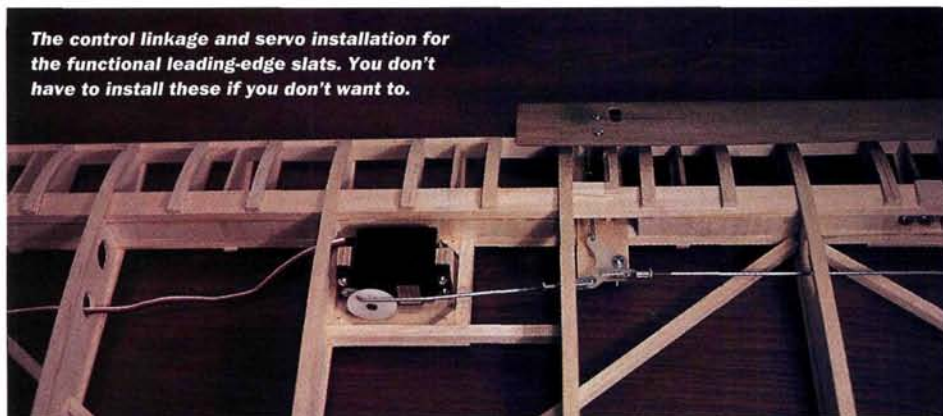




The wing structure is relatively simple and uses a scale flat-bottom airfoil. Notice the internal diagonal bracing.



The functional landing gear is scale but not difficult to build. It is made of bent and soldered music wire, and rubber bands are used for shock absorbing.



The control linkage and servo installation for the functional leading-edge slats. You don't have to install these if you don't want to.

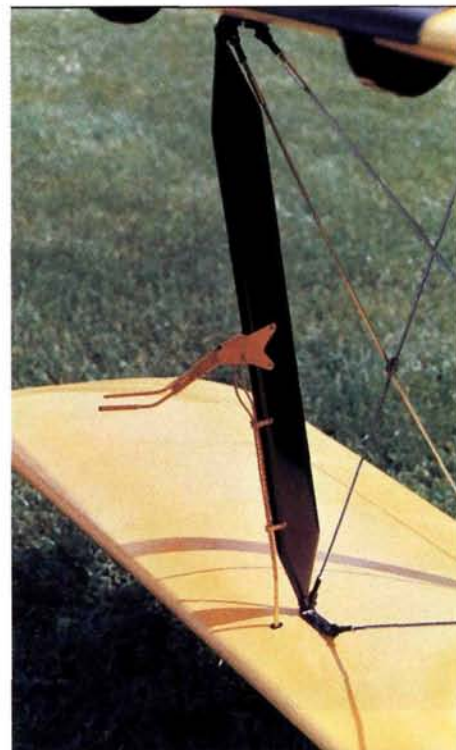
rubber-band/spreader-bar method instead of complicated-to-build Oleo struts. The main portion of the landing-gear structure is constructed of 1/4-inch music wire and the rest of 1/8-inch music wire. Balsa and basswood fairings complete the unit.

Another defining characteristic of many Tiger Moths is the distinct D.H. logo-bearing wheel cover. A simple method of fabricating and mounting versions suitable for standard Du-Bro wheels is shown on the plans.

- **Engine cowl.** The cowl follows full-scale design, and its side panels are hinged to provide access to the engine for fueling

and to make carburetor adjustments. The side panels are secured for flight with scale-like fasteners. The cowl is built *in situ* (i.e., in place) around a ply framework. The top is balsa planking, the bottom is a thick balsa sheet, and the nose is a combination of balsa blocks and planking. The hinged sides are fabricated around 1/32-inch-ply cores. Everything is then glassed with 2-ounce cloth and epoxy resin.

- **Tail surfaces.** The stabilizer/elevator and fin/rudder, which contains the tailwheel assembly, are easily removed from the fuselage. The stabilizer features a laminated-balsa leading edge. The trailing edge



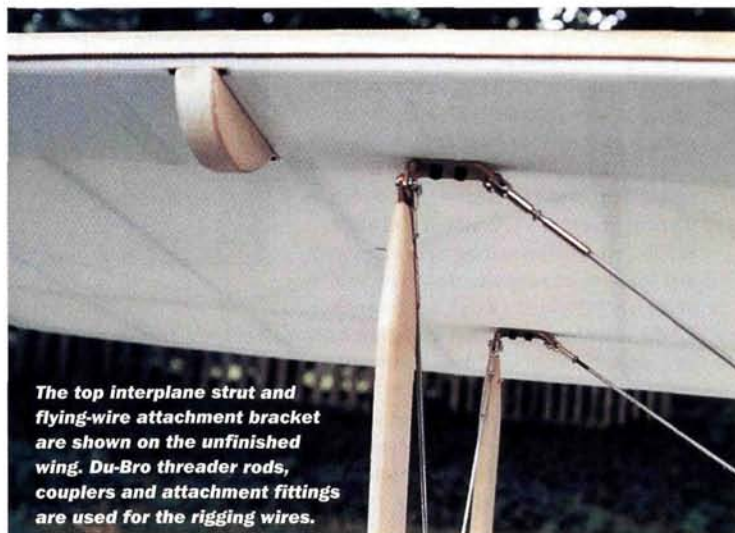
The finished interplane strut and scale Pitot-tube assembly show the model's simple but functional design. Field assembly is very quick for such a large biplane.

and capstripped ribs are 1/8-inch balsa stock. The ply portions of the center section provide the attachment points to the fuselage and the slot for the rudder assembly. Note that functional struts are attached between the fuselage bottom and the stabilizer's leading edge. The elevators are fabricated around a sheet-balsa framework. I made the scale-like elevator control horns by carefully trimming standard hobby items to size.

The fin/rudder assembly is built in much the same manner. The rudder horn and the rudder bellcrank are made of two laminations of 1/32-inch ply covered with a top and bottom lamination of 0.014-inch



The engine cowl is made entirely out of balsa and plywood. The side panels are hinged for access to the engine.



The top interplane strut and flying-wire attachment bracket are shown on the unfinished wing. Du-Bro threader rods, couplers and attachment fittings are used for the rigging wires.



carbon fiber. The tailwheel assembly is made with music wire, various sizes of brass tubes, sheet brass, wheel colors and hardware-store springs. The finished assembly looks quite convincing and is very functional.

The control cables are commercially available and work quite well. It is important to make sure that the cables are securely attached to the rudder and elevator control horns. Make them easily detachable if you plan to remove the tail assemblies for model transportation.

## WING PANELS

The top and bottom wings are constructed similarly. They feature 1/4x5/8-inch spruce or basswood front and rear spars, 3/32-inch ribs and false ribs and capstrips. The bottom wings use large barn-door ailerons that are driven by high-torque servos. The top wing has leading-edge slats. The mechanism shown on the plans is similar to that used on full-size aircraft and isn't too difficult to fabricate. Forego this option unless you enjoy fiddling.

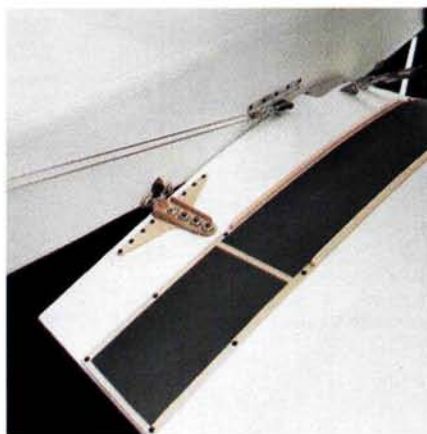
• **Rigging.** The process for rigging the finished model is quite simple and is described fully in the detailed construction instructions. The flying and landing wires as well as the interplane brace wires are all functional. I fabricated them out of 4-40 threaded rods, threaded couplers and Du-Bro threaded and solder attachment fittings. The interplane struts are basswood. Make the attachment fittings from 1/16-inch brass stock and attach them to each wing panel at the front and rear spars with 4-40 bolts. The landing- and flying-wire anchors are part of the wing-root structures, so the entire rigged wing-panel assemblies (with interplane struts in place) can be handled as a unit during assembly and disassembly. Only five bolts per wing assembly hold everything together.

## COVERING AND FINISHING

I used Solartex fabric covering throughout. I simulated the rib stitching by using glue dabs and medical-paper adhesive tape for the rib tapes. I painted the model with paint-store-mixed polyurethane enamel, and then I added the various other surface details such as the venturi and Pitot tubes, windscreen, fuel lines (containing the leading-edge-slat servo wires), cabane bracing wires, flying hood-attachment points, anti-spin strakes, etc.

## FLYING

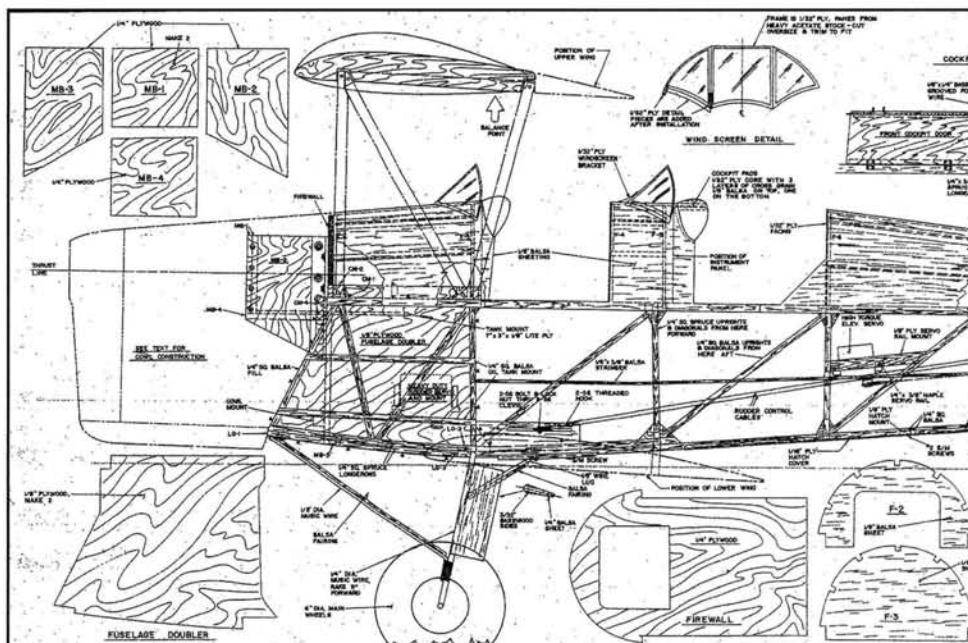
Takeoffs are very easy, even in slight crosswinds, and require very little rudder



## 30%-SCALE TIGER MOTH FSP0704A

Designed by scale competitor Gary Allen, this is a great-flying classic biplane. Traditional balsa and plywood construction is used throughout, and the rigging wires are functional. The plans include many scale details to build any of several variants. WS: 105.6 in.; L: 86.1 in.; W: 24 lb.; Zenoah G-45 engine; 4 sheets; LD 3. **\$29.95**

**Top:** author Gary Allen fires up the trusty Zenoah G-45. **Shown here with the model,** Gary gives you a sense of just how big the 30-percent-scale model really is. **Above left:** this photo of the unfinished wing and fuselage shows the impressive scale treatment the author used throughout. Notice the dual rudder pull-pull cables and the functional wing-attachment bracket. **Above right:** this close-up of the all-wood engine cowl shows what's possible with a little effort. Once painted, the cowl looks exactly like the all-metal full-size version.



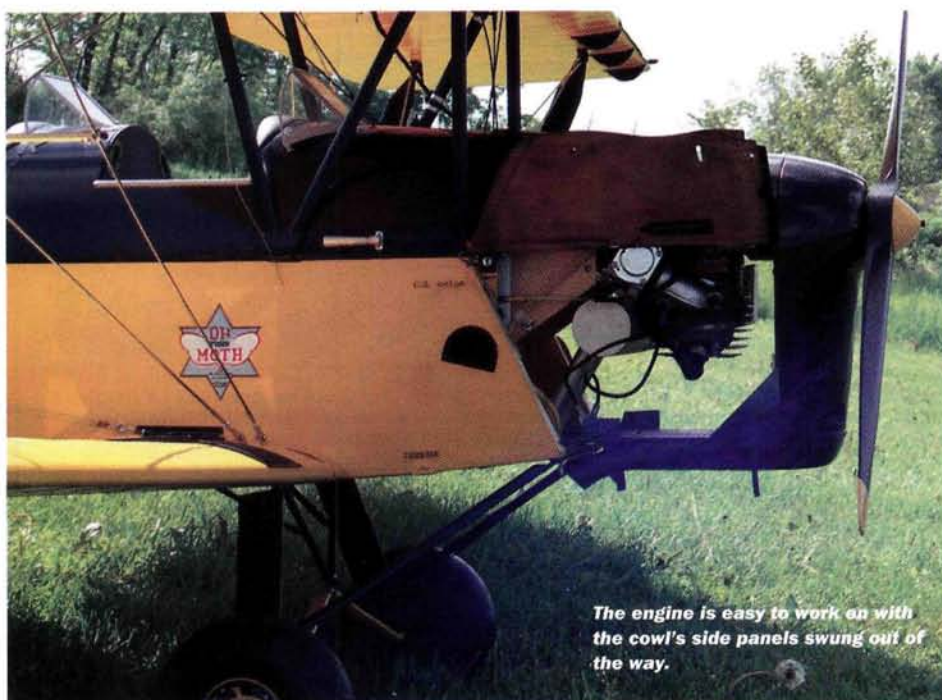




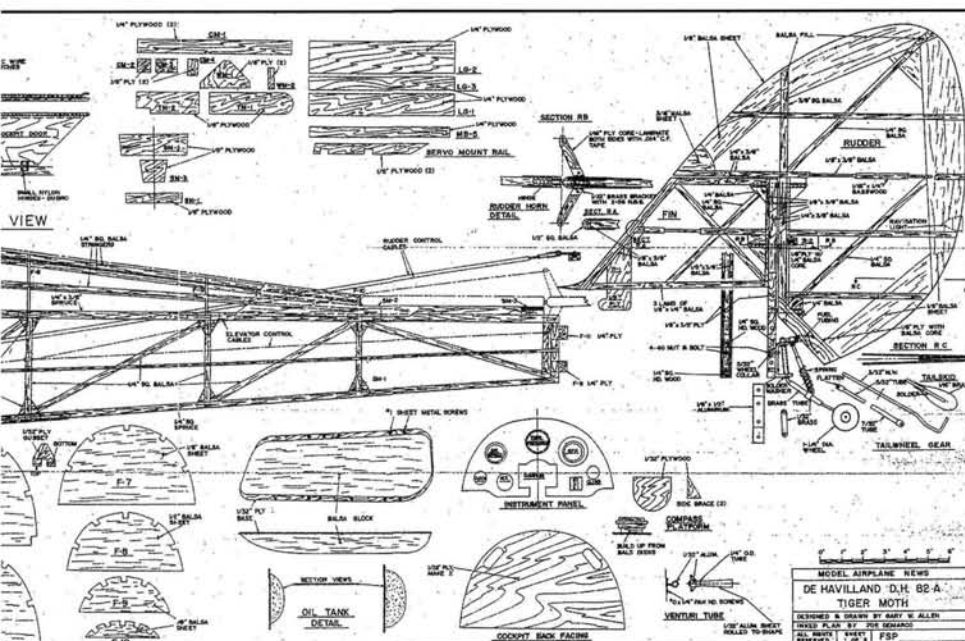
The more you look, the more there is to see! Gary's model is truly a work of art. The degree of scale fidelity is of masters' competition level.



The top wing center section on the full-size aircraft was also the main fuel tank. The author used long strips of balsa, plywood, small pieces of brass and aluminum tubes and some miniature screws to replicate the finest details.



The engine is easy to work on with the cowl's side panels swung out of the way.



To order the full-size plan, turn to page 124, or visit [restore.com](http://restore.com) online.

correction. Scale takeoffs are best achieved by slowly advancing the throttle and holding a bit of up-elevator as the model starts to roll. Even with only a 10mph headwind, the model will lift off within a few feet when you apply full power. Turns require a bit of coordinated rudder, especially during the climbout. As with the full-size Tiger Moth, which featured a significant positive decalage, you must advance the throttle to climb and retard the throttle to descend.

The model is capable of amazingly slow flight. Though not dramatic, deployment of the leading-edge slats enhances slow-speed control. The Tiger Moth could never be mistaken for a Jungmeister, but it is nevertheless quite capable of many aerobatic maneuvers. Really nice loops, stall turns and wingovers are all easily within its capability, though its roll performance leaves something to be desired. Even with differential aileron and the judicious use of the rudder, an alarmingly slow barrel roll is the best that I can achieve.

Spin behavior, however, is a pleasant surprise. Even fitted with its anti-spin strakes, this model readily enters a spin from a stall with full right or left rudder, corresponding aileron and full up-elevator. Neutralizing the controls immediately ends the spin. The spin rate is slow enough to allow an easily controllable exit in any desired direction.

As with most biplanes, landings are best done by maintaining a bit of power until just before touchdown. Even on tarmac, this model has no tendency to ground loop. Due to its very light wing loading, this Tiger Moth is not at its best in strong, gusty winds. It is perfectly safe to fly under such challenging conditions, but precise maneuvering requires flying abilities far beyond my own.

All in all, this model provides a very docile (and, at the same time, spirited) flying experience. I really enjoy flying my Tiger Moth in the early morning calm, shooting touch-and-go's, side-slipping and executing low, slow flybys. If you decide to build your own version, I hope you enjoy the experience as much as I did. ✦

**Bisson Custom Mufflers** (705) 389-1156; [info@bissonmufflers.com](mailto:info@bissonmufflers.com).

**Du-Bro Products** (800) 848-9411; [dubro.com](http://dubro.com).

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# FMA DIRECT FS8 Co-Pilot Receiver

by Joe Welsh

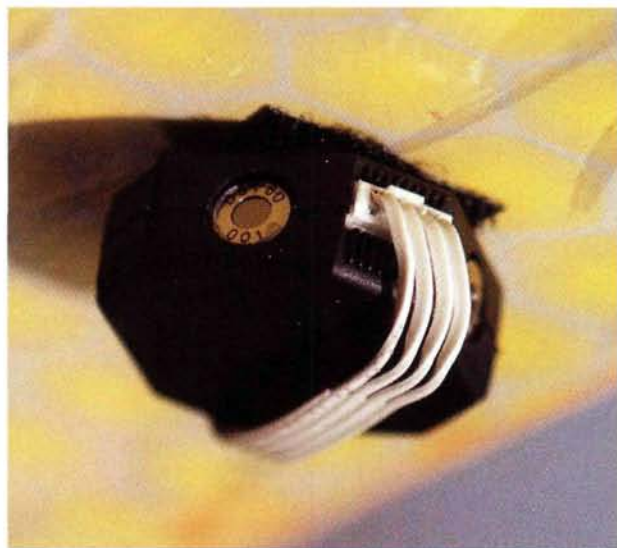
*A new-generation flight-stability system with fail-safe!*

**D**URING RC FLIGHT TRAINING, whenever student pilots lose control of their models, they have always had to rely on their instructors to save the day. Whatever the cause, it's often very difficult for a new pilot to figure out how to right his model in time to avoid an unintentional "landing."

FMA Direct recognized the need for a flight-stabilization system to help make learning easier, and it introduced the add-on "Co-Pilot" system that provided elevator and aileron control corrections (see our review in the June 2002 issue of *Model Airplane News*).

The new FS8 Co-Pilot system is a huge leap forward, as it combines an 8-channel, programmable, fail-safe FM receiver on one printed-circuit board. Because the Co-Pilot works with all 8 channels, it can stabilize flight in a variety of ways.

Like the original Co-Pilot, the FS8 allows a student pilot to simply release the transmitter's control sticks and let the system bring the plane back to straight and level flight. A host of other features makes it useful for experienced modelers as well. For this review, I installed the FS8 with an optional vertical sensor in a Hornet trainer ARF.



Velcro holds the pitch/roll sensor on the fuselage's bottom.



## INSTALLATION

The FS8 consists of a pitch/roll sensor, a vertical sensor and a special receiver with connections for 8 servos and the infrared sensor module leads. I attached the pitch/roll sensor to the plane's belly, but you can install it anywhere, as long as it isn't in the exhaust stream and it has a clear "view" of the horizon on all sides. If you install it on a wing, you may have to disconnect it from the receiver when you remove the wing to transport your model. I installed the vertical sensor on one side of the fuselage; it has a clear "view" of the sky and the ground. The Co-Pilot comes with a small module that must be accessible because it has two buttons and an LED light that are used for calibration. I mounted it on the left side of the fuselage so it wouldn't be sprayed with exhaust oil.

After you've mounted the sensors, you must calibrate the Co-Pilot each time it's installed on a new plane. Place one or two cups of hot water near the sensors to "teach" the Co-Pilot the orientation of the mounted sensors. The Co-Pilot has one feature that you would typically find only on a

more expensive PCM receiver: once it's calibrated, you may program the fail-safe positions for each channel. Thanks to the feedback given by the FS8 at each step along the way, the calibration process is fast and easy.

The manual recommends that you use the flight-stabilization feature as a fail-safe preset, but it does not explain why. An advanced pilot doing aerobatics would prefer to fly with the flight stabilization turned off so that he has complete control over the plane. If the plane loses radio contact for any reason, the flight stabilization turns itself on to stabilize the model, and the servo fail-safe presets then take over. Keep in mind that you can only program the flight stabilization to turn itself on if your transmitter has at least 5 channels. There isn't any guarantee that your plane won't be damaged during a fail-safe-activated landing, but a radio-signal loss usually means your plane will be lost to a crash.

## FEATURES

In addition to the flight-stabilization and fail-safe features, the FS8 receiver has other features that make it stand out. When you turn on the system (with the transmitter off) before you fly, it will check your channel for interference and will alert you if it detects any. It will also tell you the battery voltage within 1/10 volt. Once the plane is airborne, the Co-Pilot uses "Digital Signature Recognition" to distinguish between random interference and your valid transmitter signal; this helps to eliminate servo jitter. If it



briefly receives a bad signal—it checks 50 times per second—it tells the servos to stay where they are until the signal clears up. If a bad signal lasts for more than 1 second, the FS8 engages the fail-safe mode. It then returns the plane to straight and level flight and moves all the servos to their programmed positions until it receives a good transmitter signal again. After you've landed your plane, the FS8 will display the number of times it entered fail-safe and how many bad signals (interference) it encountered while it was turned on. In my opinion, the FS8's ability to deal with radio interference is among its most impressive features.

Even in adverse weather, the system's ability to recover a plane and return it to a straight and level attitude works very well. It uses infrared detectors to "see" the horizon

and to keep the plane flying parallel with it. The FS8 Co-Pilot also works with helicopters and any other airplane-control configuration, such as dual aileron servos, V-tails and flying wings.

#### PC READY

The FS8 comes with computer software that allows you to read additional flight information such as the battery's lowest voltage during the flight and the real-time transmitter-signal strength "seen" by the receiver throughout the flight.

FMA plans to release a "black box" device that will be connected to the FS8 Co-Pilot to record all servo movements, signal strengths and several other parameters throughout the flight. After you've landed the plane, you'll be able to view this information on your home computer. Neat!

#### AT THE FLYING FIELD

Before you fly with it for the first time, you must calibrate the FS8. Place the model on level ground, turn on your transmitter, press down and hold the "CAL" button for 2 seconds. The light on the side of the fuselage will tell you how well the calibration is working. For planes equipped with the vertical sensor, walk 10 feet or more from the plane and move any stick on your transmitter to complete the calibration process. If you aren't using the vertical sensor, you still have to complete a calibration that involves standing the plane on its nose so that



The vertical sensor attached to the side of the fuselage.

*This VMAR Hornet Sport Trainer is a moderately aerobatic model that made an ideal testbed for the FMA Co-Pilot system.*



## specifications

**MANUFACTURER:** FMA Direct

**MODEL:** FS8 Co-Pilot

**INPUT VOLTAGE:** 3.5 to 9 DC

**OPERATING CURRENT:** less than 10mA (not including draw from servos)

**WEIGHT:** 1.9 oz. (with button/LED module, pitch/roll sensor, vertical sensor and cables)

**LEVELING RESPONSE TIME:** 1/60 sec.

**DRIFT FROM LEVEL:** less than 2 deg. if the Co-Pilot has been properly calibrated

**HUMIDITY:** sealed sensor, so it is not affected by humidity

**USE WITH:** all aircraft types, including helicopters, dual aileron servos, quad flaps, elevons, V-tail, complex transmitter mixes, digital servos and CCPM

**FEATURES:** flight-stabilization system that can put your plane back on a straight-and-level course (even from inverted flight); receiver has advanced features that help to predict interference problems and to handle those that occur.

**COMMENTS:** If your transmitter is properly equipped, you can turn flight stabilization on and off and control the degree of stabilization; the Co-Pilot works in all weather and at night.

#### HITS

- Easy-to-follow instructions.
- System provides excellent feedback through externally mounted light.
- Checks your channel for interference before you fly.
- Loaded with useful features.

#### MISSES

- None.





The system has easy-to-use calibration buttons.

the Co-Pilot will know when the plane is in the horizontal or vertical position.

To turn the system on and off and to adjust its sensitivity, I assigned the Co-Pilot to one of my transmitter's adjustable knob controls. If your transmitter has only an on/off switch function such as the landing-gear retract switch, you'll be able to turn the system on and off, but you will have to adjust the Co-Pilot's control sensitivity with a small screwdriver. If you use it with a 4-channel transmitter, the system will work

fine, but you won't be able to turn it on and off with the transmitter.

In flight, the FS8 was nothing short of amazing. I did my best to trip it up by putting it in the worst possible situations, and the system corrected it every time. I tried inverted flight, 90-degree nose-up and nose-down positions, knife-edge and everything in between. Whenever I took my hands off the control sticks, the plane returned to straight-and-level flight within seconds. The system

should be recalibrated if the weather changes significantly during the day.

Since the Co-Pilot tries to keep the plane on a straight-and-level course, it effectively reduces control-surface travel. As you increase the system's sensitivity, you reduce control throw. When I first turned on the system during a flight (with it set on high sensitivity), I had very little influence over the controls. The plane flew straight and level, but I had to use full aileron and elevator control to make it

turn. After I had turned the sensitivity down, the plane was quite easy to control, and the Co-Pilot's flight stabilization still performed flawlessly. I recommend that you set the sensitivity to low the first time you fly and work up to a comfortable level.

#### SUMMARY

The well-written, easy-to-follow instruction manual states that the FS8 Co-Pilot should not be used to replace a flesh-and-blood flight instructor, and I agree; the system doesn't fly the plane for you. Once the trainer cord has been cut, however, it will help you get out of situations from which you might not otherwise be able to recover. There isn't any substitute for plenty of stick time. Even after you have learned to fly properly and safely, the FS8's advanced signal processing and system feedback are great features for any plane. When you're an accomplished pilot, you can turn the flight stabilization on and off as necessary. The fail-safe and automatic flight-stabilization features will be ready to turn themselves on if the need arises. ✚

FMA Direct (800) 343-2934; (301) 668-4280; [fmadirect.com](http://fmadirect.com).

VMAR; distributed by Richmond RC (604) 940-1066; [richmondrc.com](http://richmondrc.com).

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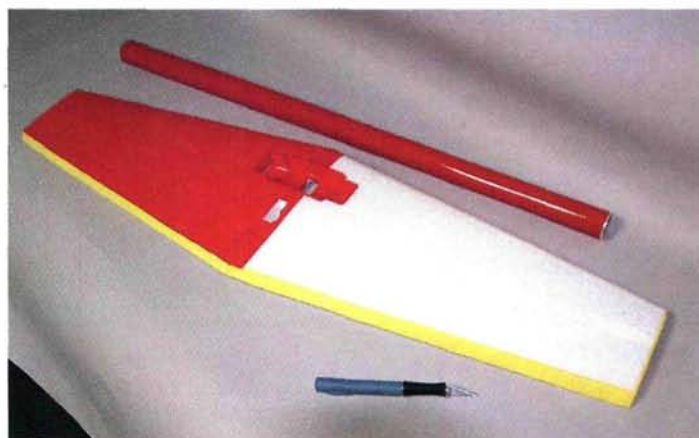
## NORTHEAST SAILPLANE PRODUCTS

# ROTO

## The Indestructible Flyer

**N**o other segment of the RC hobby has grown as explosively as electric indoor and outdoor 3D aerobatics—and it's likely to continue. Light, strong foam construction techniques; powerful, efficient brushless motors; radio equipment that weighs mere grams; and potent yet light lithium-polymer batteries have all contributed to this phenomenal growth.

To experience some of the thrill I had been hearing so much about, I decided to jump on the bandwagon and get an aerobatic foam airplane. I looked around for a model that would be 3D-capable, durable and easy to build and repair and would not break the bank. Knowing that Northeast Sailplane Products has a wide variety of airplanes to choose from, I cruised its website, and the Roto really caught my eye. It had all of the attributes I desired and was a complete package that cost less than 95 bucks. The kit included everything except the radio system (servos, receiver and ESC) and flight battery. The kicker, though, was that the Roto is made of EPP foam and Coroplast—probably the most durable construction materials ever used for model airplanes! EPP stands for expanded polypropylene, and it differs significantly from the styrene foams we've been familiar with for years. The primary difference is its resilience; it's essentially a "rubber" foam that doesn't dent or break like regular styrene foam. And Coroplast is a plastic version of corrugated cardboard. It, too, is damage-resistant. EPP foam and Coroplast make the Roto almost indestructible!



*To improve the Roto's overall look, I covered it with foam-compatible Solarfilm SoLite. Here, I've covered half of the bottom of the wing. SoLite is easy to work with and adheres well to the foam.*

PHOTOS BY RICK BELL & DERON WERLETT



**I swapped the brushed stock power system for a brushless Mega Motor 16/7/7 that's geared 2.8:1. When combined with a Kokam 3-cell 1500mAh Li-poly battery and an APC 10x4.7 prop, the Roto will climb vertically for several hundred feet.**

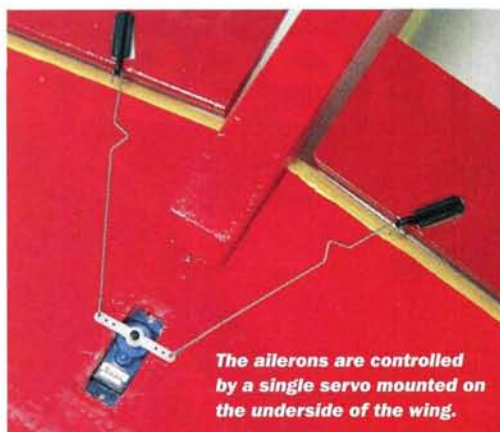


### ASSEMBLY HIGHLIGHTS

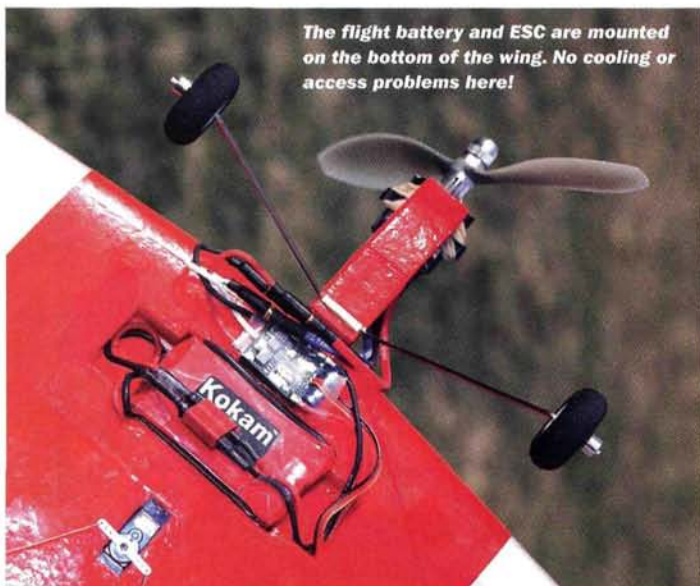
The Roto is simple to assemble, so I won't bore you with "I glued this part to that part" and so forth, but I will show you some of the changes I made to the model to suit me.

I first built and flew the model in its stock configuration. In stock form, the Roto is a fun aerobat. The included Speed 300 motor is geared 7:1 and swings a fairly large prop. Its performance was good and could be described as refined. But I wanted the power to perform more aggressive 3D maneuvers, so I used a 16/7/7 brushless Mega Motor that's geared 2.8:1 and a Kokam 3S (3-cell) 1500mAh Li-poly battery. This setup gave me outstanding vertical performance and duration.

To fit the new motor, I had to modify the nose to accommodate the new motor mount. Some simple foam removal with a sharp knife took only a few minutes, and the motor was in place. Another area that had to be modified was the pocket for the battery in the underside of the wing; it was sized for the recommended NiMH pack, and the Li-poly pack I planned to use was a little wider. Again, a few minutes with a sharp knife, and I had trimmed the pocket to the required size. To securely hold the battery in place during wild aerobatics, I cut a couple of slots through the wing and slid Velcro straps all the way through the wing and around the battery. I assembled the rest of the Roto as instructed.



**The ailerons are controlled by a single servo mounted on the underside of the wing.**



**The flight battery and ESC are mounted on the bottom of the wing. No cooling or access problems here!**



**Changing the motor system was easy; I cut a slot for the motor stick in the fuselage, making sure that I added downthrust and right thrust.**

### ALL DRESSED UP

Now that I had sorted out the power system, I wanted to dress up the plane without adding a ton of weight. The only drawback to EPP foam is that it doesn't look very pretty, and its texture, to me, is like alligator hide—rough and unattractive. The nice thing about EPP foam is that it takes well to paint and felt-tip markers. I wanted to try a different approach, however, and cover the model with an iron-on heat-shrink film. This way, the texture of the foam would be hidden, and the surfaces of the model would be nice and smooth. There are many coverings to choose from, and I decided to use SolarFilm SoLite that I purchased from Balsa Products. It comes in a variety of colors and weighs only 0.6 ounce per square yard. Its best feature, though, is that only very low heat is required to activate the adhesive and to shrink it. When working with foam, this is a huge plus! I also tried the SoLite on the Coroplast and, much to my surprise, it worked very well.

Working with the EPP foam proved to be very easy. I first needed to disassemble the model to its basic parts. The servos had been tightly press-fit into their pockets, and they came right out. Some careful cutting with a new no. 11 blade had the wing and tail feathers off in a few minutes. I then sanded all of the foam surfaces with a sanding pad and slightly rounded off all of the sharp edges.

Applying the SoLite film covering was pretty much like covering a model constructed of balsa.

The only real difference was using a low heat setting so that the foam wouldn't melt. I found working with SoLite fairly easy; the material is superthin and adheres well to the foam. I covered the parts and then reassembled the Roto. When I had finished, I had a sharp-looking model that doesn't look as if it's made of foam. Very cool!



**The receiver, rudder and elevator servos rest out of harm's way in pockets in the side of the fuselage.**

### SUMMING UP

Would I rate this aerobatic park flyer a success? Most definitely! The Roto is a great-flying airplane as is. For really spectacular performance, add a brushless motor and combine it with a Li-poly battery. Want to dress the Roto up a little? Use foam-safe paint or felt-tip markers, and let your imagination run wild; you'll get great results. But if you want to take the Roto to the next level, try covering it as I did. I was very surprised with the results—as were my flying buddies. Have fun! ✚

**Balsa Products** (732) 634-6131; [balsapr.com](http://balsapr.com).

**Kokam**; distributed by FMA Direct (800) 343-2934; (301) 668-4280; [fmadirect.com](http://fmadirect.com).

**Hobby Lobby** (615) 373-1444; [hobby-lobby.com](http://hobby-lobby.com).

**Mega Motor USA** (888) 800-3663; (425) 451-1269; [megamotorsusa.com](http://megamotorsusa.com).

**Northeast Sailplane Products** (802) 655-7700; [nesail.com](http://nesail.com).



# NORVEL AX-40

A HIGH-TECH, RUSSIAN-MADE POWERPLANT WITH AN INNOVATIVE DESIGN

by Bruce Smith



*The Norvel AX-40 is a high-quality, high-tech, Russian-made glow engine with several innovative features.*

**J**ust over 10 years ago, Norvel (then Northern Velocity) produced a high-performance .049 combat engine: the AMD 049. At the time, 1/2A modeling was hardly a blip on the model-aviation radar screen, and Norvel's engine completely kicked the doors open for our hobby. In Norvel's own words, it was "the first company to produce a reliable small engine with a respectable throttle." Over the past 10 years, the 1/2A RC aircraft market has grown impressively, and more new kits and ARFs are offered every year. But the revival of 1/2A wasn't enough for the company; Norvel has marched on to produce engines with larger and larger displacements. Enter the long-awaited Norvel AX-40.

## specifications

**ENGINE:** AX-40  
**MANUFACTURER:** Norvel  
**DISTRIBUTOR:** Sig Mfg.  
**DISPLACEMENT:** 6.48cc (.40ci)  
**BORE:** 20.85mm (0.82 in.)  
**STROKE:** 19mm (0.75 in.)  
**COMPRESSION:** 9:1 to 12:1  
**LENGTH OVERALL:** 3 1/4 in.  
**WIDTH AT MOUNTS:** 2 in.  
**HEIGHT OVERALL:** 3 in.  
**PRACTICAL RPM:** 2,000 to 16,000  
**POWER:** 1.4hp @ 16,000rpm  
**WEIGHT W/OUT MUFFLER:** 10.79 oz.  
**PRICE:** \$109.99

**FEATURES:** the Norvel AX-40 engine has an aluminum piston and an aluminum cylinder with an oxide ceramic coating covered with Sliktek, a proprietary cylinder coating and a single-unit cylinder and head; investment-cast aluminum crankcase; two ball-bearing races; a hard-anodized prop hub; a keyed prop nut/washer; an adjustable prop shaft; and a 2-year warranty.

**COMMENTS:** the AX-40's AAO construction is revolutionary, and the engine was very easy to use. It was easy to start and adjust and is extremely well made. It boasts slick machine work and precision casting.

## NORVEL'S REVOLUTION

Engine manufacturers have typically depended on either ABC or ABN technologies—essentially a heavy brass sleeve with either hard chrome or nickel plating. Norvel knew that it had to do something revolutionary to make its mark in the model-aircraft-engine market. Norvel's engineers, among them some of the former Soviet Union's best aerospace talent, decided to make their engines unique. The team wanted to manufacture lighter, more fuel-efficient model engines, so they developed a new cylinder/piston technology: AAO Revlite.





**The 2-needle carburetor has a unique shape that slants the main needle valve aft and away from the prop.**



**The cylinder head has a unique multipiece design. The three tapered holes in the central ring are for setscrews that provide additional support of the combustion chamber when high-nitro fuel is used.**

Revlite engines feature an aluminum piston with an aluminum cylinder that has an oxide coating (ceramic plating) lined with Sliktek, Norvel's proprietary cylinder coating (think Teflon). Sliktek protects the porous ceramic coating to reduce friction and improve fuel efficiency. Norvel says that its Revlite cylinder technology improves combustion and increases power by 20 to 40 percent. An aluminum cylinder sleeve offers a weight savings of 20 to 25 percent and a comparable fuel-efficiency gain. All Norvel engines use the new Revlite technology.

### **NORVEL AX-40**

The AX-40 is the largest Norvel engine, and it's the first to be produced by its new production equipment. The new AX-40 weighs only 13.2 ounces; a comparable O.S. engine weighs 17.2 ounces. Many AX-40 features resemble those of its smaller-displacement siblings. Its cylinder and head are combined in one component that is bolted to the investment-cast aluminum crankcase. The crankshaft is supported by two ball-bearing races and features a hard-anodized prop hub and a nut/washer combination. As in its smaller units, Norvel employs the reversible prop shaft that effectively shortens the overall working length of the crankshaft to further reduce vibration.

All of the AX-40 components scream "high quality." At the top of the CNC-machined cylinder head, two additional inserts complete the engine's combustion end: the glow-plug adapter, which is set at the top of the cylinder, and the top cover, a threaded ring that secures the plug adapter. The top cover has three threaded holes that are intended for the use of setscrews, which supply additional support for the adapter plate and lock the



**The cylinder sleeve includes the cooling fins and has a ceramic coating. The inner surface of the sleeve that houses the piston has been lined with Sliktek. The central ring, head button and head shim are also shown.**



**The head button and head shim are held in place over the combustion chamber with a central ring that's threaded into the top of the cylinder sleeve. A special wrench is needed to remove the ring.**

plug-adaptor plate further when you use higher nitro fuel (up to 35 percent).

The 2-needle-valve carburetor features an angled-back design that makes needle-valve adjustment safer. This is by far the best machined, highest-quality Russian carburetor I have ever seen. It has the fit, finish, material and hardware quality you would expect of a high-performance engine. To quiet the engine, the standard muffler is a very nicely cast unit that I feel lets the engine breathe without compromising the noise limits of even the most restrictive air-fields. The instruction manual is comprehensive, clearly written and well-supported with drawings, photographs and 3D CAD carburetor schematics. It covers all the topics you'll need to break in, fine-tune, care for, maintain, choose propellers, glow plugs and fuel, troubleshoot and obtain maximum performance. If you ever need to repair your engine, the manual also features a complete exploded parts view and parts table. The stamp and signature of a "real person"—the person who tested the engine to ensure that it complies with all technical specifications and quality conditions—is a very nice touch. The AX-40 is covered by a 2-year warranty.

### **GET YOUR ENGINE RUNNING**

Well, friends, it's time for the rubber to hit the road. I used a McCoy MC-59 glow plug (medium heat range), an APC 10x6 prop and Sig all-synthetic oil, 10-percent nitro fuel for break-in. After I had primed the engine with a few propeller hand-flips with my finger covering the venturi, I set the carburetor at a fast idle, engaged the glow igniter and gave the prop a few backflips. The engine popped with little effort, started and then stopped—not unusual for a tight new engine. After a couple of minutes of repeating this pattern, the runs began to last longer and longer until the engine stayed ignited. Once the engine



## Norvel AX-40 Performance with standard muffler

Propeller	Rpm	dB*
Top Flite 11x6	11,300	90
APC 11x4	12,270	92
Top Flite 11x4	12,330	92
APC 11x3	13,830	95
Top Flite 10x8	10,560	90
Top Flite 10x7	11,220	90
APC 10x6	12,500	93
Top Flite 10x6	12,630	93
APC 10x5	13,590	95
Top Flite Powerpoint 10x5	12,660	94
APC 10x4	14,520	95
APC 9x6	15,270	97
Kyosho 9x6	15,120	96
<b>Open port</b>		
APC 9x6	16,290	106

TEST CONDITIONS • Temperature: 54 deg. F  
Humidity: 33% • Barometric pressure: 30.31 in. Hg  
Fuel: Sig Syn-Plus 10% nitro/18% synthetic oil  
\*Decibel readings measured at 3 meters

had warmed up, I advanced the throttle and made sure that the fuel mixture was set rich. I continued to break in the engine (at a rich needle setting) and went through ½ gallon of fuel, 10 ounces at a time, with cooling periods between each tankful.

At this point, the engine was ready to be tested with the props that I had selected. I ran the engine tuned to ⅛ turn on the rich side of peak rpm. The performance tables include the rpm and decibel readings for each of the test props.

### CONCLUSION

The Norvel AX-40 is an extremely well-made engine that boasts slick machine work, anodizing and precision casting. The engine is very user-friendly, easy to start and quick to cool, and it has a dependable idle and a lightning-quick throttle response. It's also easy to fine-tune. Norvel's goal of greater fuel efficiency was accomplished; turning an APC 10x6 at 12,500rpm, the engine consumes 10 ounces of fuel in about 16 minutes. The AX-40 is a revolutionary engine! ✚

APC Props; distributed by Landing Products  
(530) 661-0399; [apcprop.com](http://apcprop.com).

Great Planes Model Distributors (217) 398-6300;  
(800) 682-8948; [greatplanes.com](http://greatplanes.com).

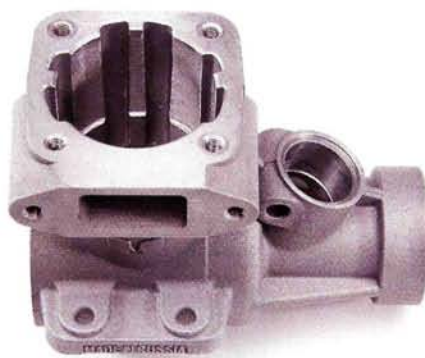
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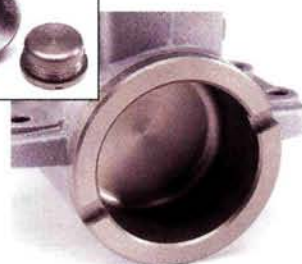
## An inside look

When Norvel started out in 1990, the company's production equipment was old Soviet-era CNC aerospace industry machinery. Its equipment was slow and antiquated but produced high-quality engines up to a .25cc displacement. To build larger engines and to produce them in quantity, Norvel made the expensive switch to modern multi-axis equipment. Following Russian economic shortfalls, the company won approval from its aerospace-electronics parent company to upgrade its outdated equipment with nearly 2 million dollars' worth of state-of-the-art CNC machinery. Norvel never looked back! A look at the AX-40's internal parts proves that the company's money was well spent.



**Above left:** with the cylinder sleeve removed, you can see the port passages that are cast into the engine case. Note that there are two pairs of bypass ports and two boost ports.

**Above:** each of the six port passages has its own port opening in the sleeve. The openings are machined at an angle to direct the fuel away from the main exhaust port. **Left:** the connecting rod has two oil-passage holes drilled in the lower bushing, and the piston body has two holes drilled into it to supply oil the rod's top bushing and the wristpin with oil. The wristpin is held in place with two E-clips.



**Above:** the crankshaft is very stout and precisely machined for smooth operation. The threaded prop shaft is screwed into the front of the crankshaft and can be installed for a long or short thread length.

The AX-40 has a clever rear engine-case plate design. It threads into place for a positive, no-gasket seal.





# Classic Model Airplane News

by Matt Boyd



... the cover of *Model Airplane News* showed the exciting potential of RC aviation—no, not the pretty girl—the experimental floatplane! Radio gear allowed flight to be explored more fully than ever and opened up possibilities that

## 50 years ago ...

those who flew the free-flight and control-line models of a few years earlier couldn't hope to exploit.

... butyrate dope was a staple of model finishing, and Testors was

one of the biggest sources. Dope is durable, fuelproof and offered in an excellent choice of colors. Within 15 years or so, MonoKote and other heat-shrink film coverings offered many of the same virtues as dope without the mess and toxic fumes. For those who believe in old-school modeling, however, dope still produces a great finish.

... *Model Airplane News* showcased innovations in all facets of RC—not just planes. One such development was in the area of outboard boats. This ad for Sterling Models' Sea Dart touts the speed potential of this hull type, and within just a few years, K&B engines were the powerplants of choice for high-performance outboards.

... our July 1979 issue celebrated 50 years of *Model Airplane News* with another striking cover by Jo Kotula. This one was specially commissioned to represent the progress aviation

## 25 years ago ...

technology had made since *Model Airplane News* first hit the stands.

... engine guru Peter

Chinn outlined the principles of proper carburetor and throttle tuning. He explained the ins and outs of the common carbs of the day with exploded-view photos, detailed descriptions of their operation and helpful adjustment tips. Some of the equipment has changed, but the techniques and principles explained in this article still hold up even after 25 years.



... we over-powered readers with a roundup of 32 .40-size 2-stroke engines and provided the keys to selecting the best powerplant for your

needs. This wasn't the first guide of its type, and it certainly wasn't the last, but it does show *Model Airplane News'* long-standing commitment to helping you find the best performance and value and to be successful in the hobby.

... ace pilot and designer Dave Patrick taught readers how to master a staple of aerobatic competition with his column "Tackling the Torque Roll." He shared his tips on airplane selection and setup and detailed, step-by-step, piloting techniques to help aspiring aerobats achieve top scores at their next meet.

... jets were all the rage, and we showed off some of the best in our coverage of the 5th annual Jets Over Deland.

Virtually all the competitors used ducted-fan power in 1994, but the occasional turbine certainly grabbed our attention. Ten years later, turbines are the rule, and ducted fans—though not exactly rare—are in the minority at top jet competitions. ✦



## 10 years ago ...



# Resin Casting Aircraft Parts



**G**uns, exhaust stacks and other small parts that are commonly used on a typical scale model are easy to cast out of urethane resin, using silicone mold-making materials. I used this method to make guns, exhaust stacks and wingtips for a large Fairey Firefly and machine guns for a Heinkel 111. Parts for the Firefly featured in the March 2003 issue of *Model Airplane News* were made by the same casting process. You can make parts of almost any size.

Here's an outline of the process:

- Make patterns of the parts you want to mold.
- Attach sprues to the patterns, if necessary.
- Attach the patterns, or the sprues, that hold the patterns to a smooth surface.
- Build dams around the patterns to contain the molding material.
- Pour the molding material around the patterns and let it cure.
- Extract the patterns from the molding material.
- Make parts by pouring urethane casting plastic into the molds.
- Extract the cast parts from the molds.

For frequently needed parts such as exhaust stacks, you can assemble several cast parts into a more complex pattern, add sprues, and then pour molding material around the larger pattern.

This process may seem complicated, but it's really only repetitious; at most, you have to carve only one left and one right part. The rest is pouring and waiting. It sure beats building eight machine guns or carving 12 exhaust stacks! It's even better than carving two air scoops.

## CREATE THE PATTERNS

Your patterns don't need to be strong; dense foam covered with lightweight spackle will work, and so will balsa, basswood, white pine, etc. You can even make patterns out of modeling clay and

*After they've been painted and glued into place, resin-cast parts look very professional. This procedure takes much less time than it would to carve each stack individually.*



plasticine; they're really stiff when cold. Good pattern material is easy to carve and smooth (any surface grain or texture on the pattern will be faithfully recorded and will make the pattern and parts more difficult to remove from the mold!). It also helps if you can glue small details to the material.

The exhaust pipe patterns shown have small beads of Elmer's glue down their sides and around the ends to simulate the welding line. I applied them to the patterns with a toothpick. Keep details such as these very subtle.

## PREP WORK

If your part needs to be molded on all sides, you must add sprues to the patterns. You can make sprues out of modeling clay, dowels, sticks, pencils, etc. They are used to leave a hole in the mold into which you can pour the casting plastic and let the air escape. Stick the pattern sprue to the pattern in a position that allows you to easily cut the molded sprue off the finished part. Glue sprues on fully cast parts (such as the machine guns shown) to a surface near the end of the part, so the casting material can flow into all



*This is the material I use to cast scale airplane parts.*



## MAKE THE MOLD

The mold-making material is room-temperature vulcanizing (RTV) silicone molding rubber. You can buy it from Micro-Mark (item no. 82083) or from your local patternmaker's supply shop. Mix the molding material as directed.

A one-piece mold is made upside-down. Pour the material over the pattern and into the mold dam. This requires patience. Air bubbles can be trapped when you mix the two parts of the molding material together, and you don't want any of them to come in contact with your pattern because they will cause the molded part to cure with little bubble-shaped lumps on it. The best method is to pour the silicone over the pattern in a thin coat and let the bubbles work their way out. Then pour the material down the sides of the dam, so the bubbles can escape. Pour more material as slowly as possible wherever the material touches the pattern. You have a time limit, though: the silicone material will start to gel in about 10 minutes.

the dead ends of the part. It is helpful to have sprues that will let air bubbles escape from dead ends, even when you don't need them for pouring the part. A sprue should have a wide outer end, too, so it can act as a funnel for pouring the part. If you have to pull the sprue through the mold, don't leave the sprue full of molding material when you cast the part; the wide end will hold it in the mold!

Secure one side of the pattern directly to the work base with 3M 77 spray contact cement. It must only stick well enough to prevent the mold material from leaking under the pattern during the mold pour.



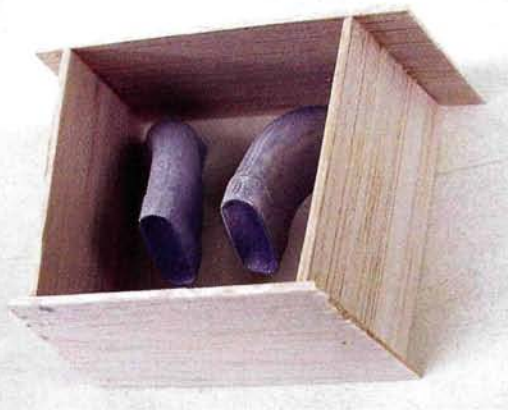
**Above:** start by making a mold pattern. Here are my individual left and right exhaust stacks. Notice the weld detail formed with beads of glue. **Left:** secure the patterns to a smooth work surface. **Below:** build a suitable dam around the patterns to contain the mold-making compound.

## MULTIPART MOLDS

Many parts require that you build a two-part mold so you can remove them from the mold. Really complex parts may need to be molded from more than two patterns. Here is the procedure for a multi-part mold.

Pour in the mold material so that it makes a mold of one side of the pattern. This is usually on the centerline of the molded part and on the centerlines of the sprues. Position the sprues to line up with your mold separation line.

Build a dam around the pattern to contain the mold-making material. The dam can be any stiff material, such as balsa sheet or cardboard, and it must be about 1/4 inch taller than the pattern, so your mold will have a flat bottom to rest on. Build the dam so that the mold walls are relatively thin; about 1/4 inch is ideal. If they're thinner than that, they may tear easily when you remove the parts from them. Thin, flexible walls make it easier to remove the part from the mold; you can't always do this, but keep it in mind. When you build mold dams, remember that simple rectangular or circular outsides are easy to work with and that thin walls can bend and leak. Make sure that the dam's bottom doesn't leak; the molding material is designed to get into small spaces so it will find any cracks under it. Be sure to glue the joints of the dam so they don't leak.



Do not loosen or remove the piece from the mold after you have poured the first half!

Spray a coat of fast-drying auto primer onto the surface of the mold to serve as the parting line. Cover any of the mold's surface that will come in contact with the new silicone (although the



**The empty mold is ready for resin to be poured into the openings.**

**Pour the resin in slowly to avoid trapped air bubbles, and allow the resin to cure.**



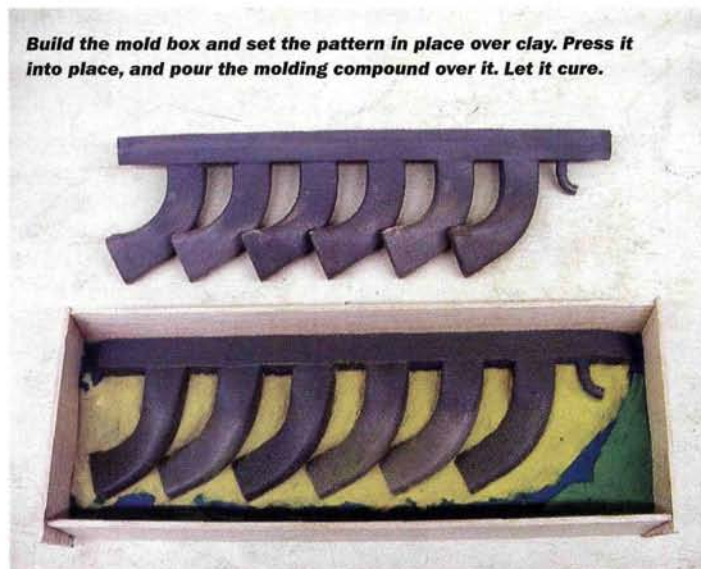
**The molded parts are identical to the pattern pieces.**



**All the assembled individual exhaust stacks form the new final patterns for the finished castings.**



**Build the mold box and set the pattern in place over clay. Press it into place, and pour the molding compound over it. Let it cure.**



## CAST THE PARTS

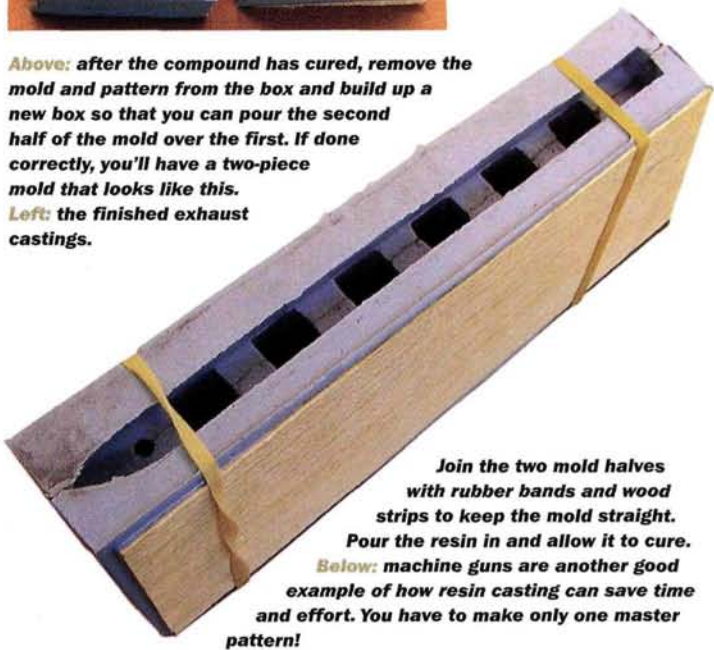
Mix the urethane casting material per the directions. I used material made by Micro-Mark (item no. 82057), but you can find other brands at a pattern supply shop, too.

First, pour a little urethane into the thin sections of the mold. Rap the mold on the bench a few times to dislodge any bubbles in the thinner parts. Then fill the mold, and allow it



**Above:** after the compound has cured, remove the mold and pattern from the box and build up a new box so that you can pour the second half of the mold over the first. If done correctly, you'll have a two-piece mold that looks like this.

**Left:** the finished exhaust castings.



**Join the two mold halves with rubber bands and wood strips to keep the mold straight. Pour the resin in and allow it to cure.**

**Below:** machine guns are another good example of how resin casting can save time and effort. You have to make only one master pattern!

mold material doesn't stick to anything else, it will stick to itself). The nice part about using paint as a barrier is that you can see if you miss a spot. You can also use a mold-release agent, but make sure that it's easy to remove from the structure you've molded when you want to paint it.

Pour the remainder of the mold material to cover the top half of the pattern. When this side has cured, remove the dam, tip the mold so the sprues point up, and attach a stiff piece of rough board to each side of the mold with more silicone. These boards allow you to use clamps to prevent the mold from flexing so that your casting material won't leak into the slot between the sides when you pour the part.

Pull the sides of the mold apart at the painted parting line, and remove the pattern and sprues. Put the mold sides together and secure them with a rubber band or a clamp. Don't overtighten; harsh clamping may distort your mold.



to cure for about an hour. The casting material expands as it cures, so don't overfill the mold, or you'll have to sand off the excess. Remember, don't leave material in the sprues if you have to pull them through the mold to remove the part! Spray mold-release on any wood or fibrous material that you used as a mold stiffener (the urethane is an excellent glue).

Finish the newly cast parts with any type of paint, and glue them to your model with any type of glue. To make the cast part fit better, sand the surface to be glued first. Make as many parts as you want; it's easy and inexpensive. †

Micro-Mark (908) 464-2984; micromark.com.



# 4-stroke valve timing

In the March 2004 issue, my "4-stroke Power" article raised additional questions about these powerplants and how they operate. In this issue, I'll discuss the basics of 4-stroke valve timing and answer some readers' questions.

The 4-stroke's intake and exhaust valves don't actually open and close at top dead center (TDC) and bottom dead center (BDC) (that is, every 180 degrees), even though, in theory, they do. In modern high-performance designs, engineers extend the intake and exhaust periods by opening valves early and closing them late. For example: the intake valve always opens before TDC at the end of the exhaust operation, and the exhaust valve always closes after TDC at the beginning of the intake operation. This extension results in both valves being open at the same time around TDC. Known as "valve overlap," this seems counterproductive to efficient, powerful operation, but it isn't.

There are two reasons for this extension of the intake and exhaust periods. First, poppet valves do not open and close instantly; like all mechanisms, they require time to move from one position to another. In many 4-strokes, the crankshaft must rotate as much as 30 degrees before the valve is opened to 10 percent of its total lift. Restricted valve openings restrict gas flow.

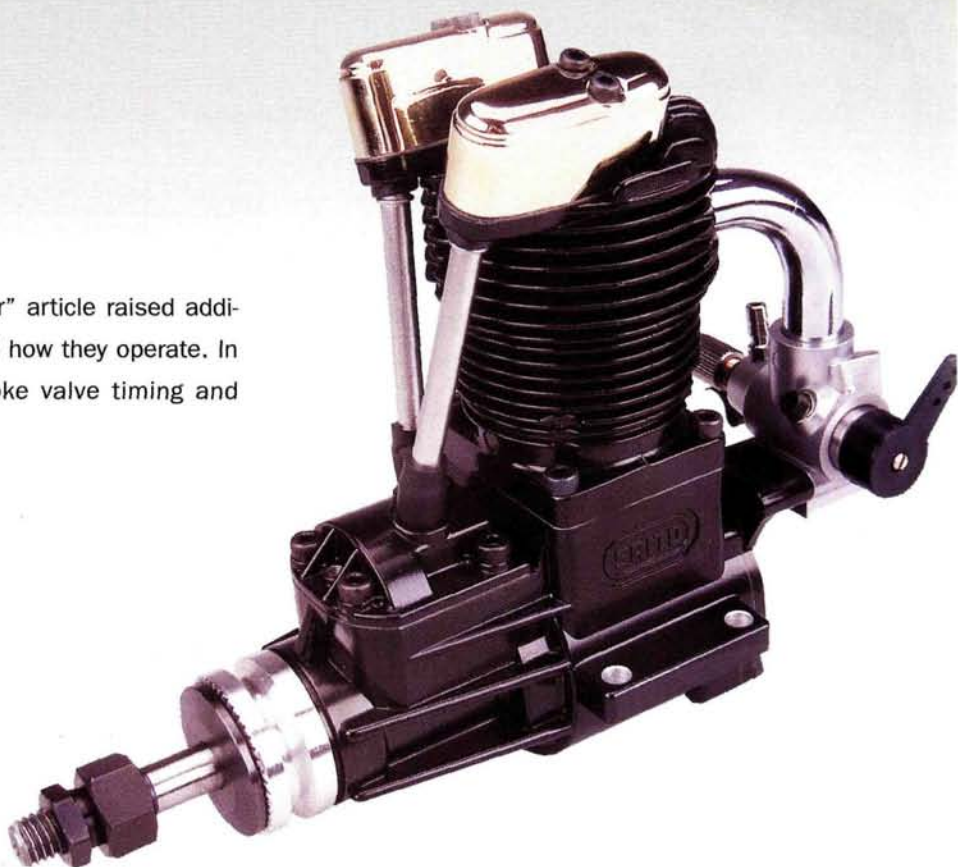
If the valves could open and close instantly, TDC and BDC still wouldn't be the best choices for their opening and closing; therefore, the second reason to extend the intake-open and exhaust-open periods involves the inertia of the gases involved. Inertia is often defined as, "A body at rest or in motion will continue in that state unless acted upon by an outside force." As the piston accelerates away from TDC at the beginning of the intake stroke, fresh air/fuel gases in the induction tract (the carburetor and intake manifold) are pushed into the cylinder by atmospheric pressure, but because of inertia, this isn't

immediate. Moving slowly at first, the induction gases try to catch up with the rapidly accelerating piston; next, the piston decelerates rapidly as it nears BDC, but the mixture charge is now moving rapidly because of the inertia of its motion. If intake-valve closure is delayed until after BDC, the cylinder will continue to fill even as the piston begins its sweep toward TDC on the compression stroke. Extending the induction period maximizes cylinder packing and enhances cylinder pressure, crankshaft torque and engine power.

The principles of inertia also apply to exhaust gases. The exhaust valve opens before the piston reaches BDC (toward the end of the power event), and this allows the still-pressurized cylinder gases to leave the engine. Dumping a bit of tail-end power-stroke pressure may seem counterproductive, but the tradeoff saves some of the rotational momentum that would otherwise be used to help scavenge exhaust gases. Because exhaust-gas acceleration and cylinder scavenging begin early, the slowing of the piston near TDC allows the formation of a negative pressure zone in the combustion chamber. The intake valve is

opened before TDC, and the partial vacuum promotes the delivery of a fresh mixture before the piston begins its intake stroke. Like the intake valve (which closes after BDC), the exhaust valve's closing after TDC enhances cylinder scavenging for the same reason: the inertia of the exhaust gases. The valves' opening and closing points affect the engine's ability to fill the cylinder with the fresh air/fuel mixture that is necessary for good torque and power production. The ideal valve timing will, however, depend on the type of engine under consideration by the designer: high-rpm, maximum-power-output engines require valves that open early and close late. Fuel-efficient, lower-power engines need valves that open and close closer to the dead centers with reduced valve overlap and less chance of the gases mixing and for reversion (exhaust escaping through the intake valve and into the intake tract).

With 2-stroke cycle port timing, the same events take place in the 2-stroke engine but are completed in one crankshaft revolution; you can imagine why events overlap, gases occupy the same space and the exhaust mixes with fresh air/fuel mixture.





## UNRELIABLE 4-STROKE

Rob Antwerpen of Neerbeek, the Netherlands, writes: I always read your engine articles in *Model Airplane News*; I really love technical explanations, so please continue writing them. I bought a Thunder Tiger F-91S during a stay in Manhattan a few years ago, but I've never been able to get it running smoothly in an airplane; that's why it has mostly been sitting in a box. The engine has been broken in nicely (according to the manufacturer's specifications) on a Graupner 11x11 propeller; I used a test bench to do this. I've now fitted the engine with an APC 13x9 prop running at top revs of 10,500rpm, static. The fuel I use is 5-percent nitro with 18-percent castor oil. (I'm not sure about this because the manufacturer doesn't specify oil content or type, although it certainly has castor in it.) The fuel is claimed to be suitable for 2- and 4-stroke engines.

When mounted in an airframe, the engine performs well when flying horizontally, but it leans out drastically when the nose is pointing upward. When I set the high-speed needle valve, it takes only four "clicks" to run it either lean or too rich, and both show as a power loss. When the high-speed needle is set rich on purpose, the engine still leans out excessively on vertical climbs, and it stops at a nose-down attitude due to the extremely rich mixture.

A conventional clunk-type plastic tank is used with exhaust pressure; I have tried setting the tank as close as possible to the engine; I disassembled the engine and fuel system to check for leaks (none found); I checked the piston and cylinder for excessive wear or signs of overheating (none found), and I re-lapped the valves on their seats. Compression is very good for a ringed engine; I used an OS-F plug throughout.

Dave, I'm absolutely lost. I've never lost an airplane during 15 years of flying 2-stroke engines, and I don't intend to let it happen with an unreliable 4-stroke.

Rob, since your engine leans out in a vertical climb, runs dead rich in a dive and you haven't found fuel-system or engine air leaks, it suggests that the problem originates elsewhere. I'm suspicious of your fuel; anytime the ingredients and percentages aren't disclosed on the label, a red flag should go up.

Three factors are critical to successful 4-stroke engine operation: type and percentage of lubricant in the fuel blend; glow-plug type; and nitromethane percentage in the fuel blend.

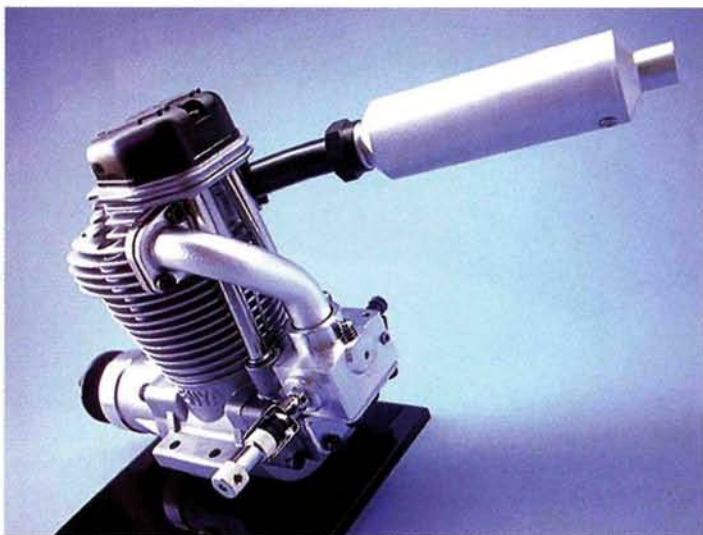
Although I usually recommend using a liberal percentage of castor oil in 2-stroke fuel blends, it isn't a good idea with 4-stroke engines. Here's some background: in 1979, when the first modern production 4-stroke engine was released (O.S. FS-60), many of us tried using standard 2-stroke glow fuel with all-castor-oil lube; after all, castor provided the best protection against damagingly hot, lean runs (and still does). Although the new engine was able to fly our models, it ran roughly at wide-open throttle (WOT), had poor throttling characteristics and a narrow needle-valve range between rich and lean operation.

The late George Aldrich discovered that by reducing the fuel's oil content from 20 to about 14 percent (by volume), the engine ran much better. George guessed that castor oil droplets in the 20-percent mix cooled the glow plug's heating element during the non-firing portion of the cycle and caused a misfire or flameout. Because 4-stroke engines fire only once on every other revolution of the crankshaft (half as often as their 2-stroke counterparts), his theory made sense. Although the lean oil trick worked OK, it didn't leave room for mistakes; inadvertent lean needle-valve settings quickly deprived the engine of vital lubricant and wallowed-out bearings, wristpin bores and scored pistons.

Today, we have a better understanding of the problem and how to handle it. First, "hot" 4-stroke glow plugs have been developed to help continue ignition from cycle to cycle. Your choice of the OS-F plug is a good one. Second, castor-oil content has been severely curtailed or eliminated altogether in 4-stroke fuel blends. Why? Castor oil does a very effective job of carrying away excess heat—not a good thing with relatively cool-running 4-stroke engines. The next time you're at the flying field, identify two models powered by 2-stroke-cycle engines: one that uses all synthetic oil and one that uses all castor oil in the fuel blend. After each engine has been started, warmed and adjusted to peak power at WOT, place a finger or two in the exhaust stream far enough behind the muffler outlet to avoid getting burned but close enough to feel the heat. You may be surprised to find a cooler exhaust with synthetic lube. Synthetic oils do a better job of lubricating than they do of cooling the 4-stroke engine; a greater percentage of the engine's waste heat, with its higher temperature, is carried over to the next cycle and helps to keep the plug element hot.

Finally, increased percentages of nitromethane release more heat into the cycle, and that enhances glow-plug operation. Four-stroke engines tolerate elevated percentages of nitro, although cost is a concern (about \$35 per gallon); however, since the 4-stroke is more fuel-efficient than a 2-stroke, fuel expenses are somewhat offset.

Rob, your fuel is deficient in two of three areas: it's too low on nitro content, and you're using the wrong type of lube; try some 15- to 20-percent-nitromethane fuel with 20- to 22-percent synthetic lubricant; I think your engine will like it.



## 4-STROKE BREAK IN

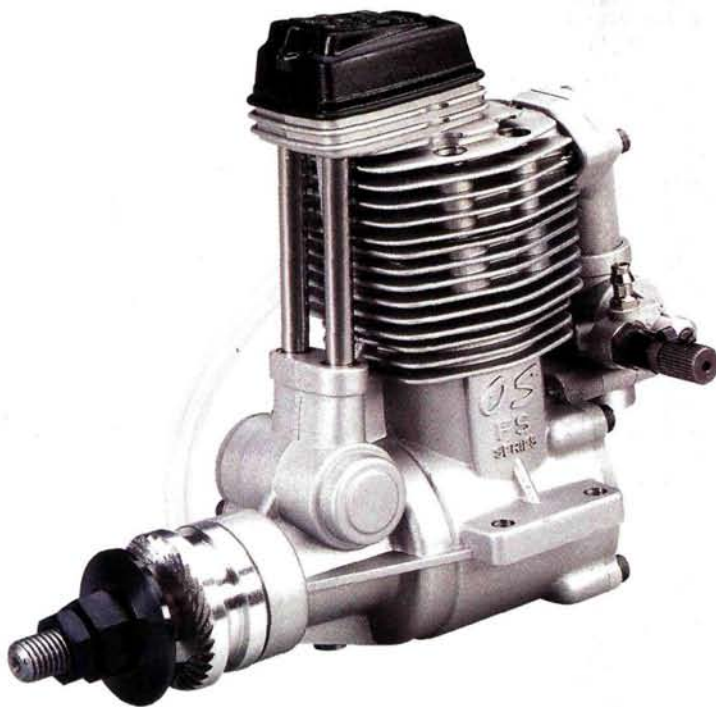
Dale Nash emails: I have heard several methods and different advice on 4-stroke break-in procedures. Some say that the manufacturers' directions are not the best way to break in new 4-strokes. Can you help?

Dale, after reading about break-in procedures for 4-stroke engines in dozens of instruction manuals, I'm also left scratching my head. Without reviewing all of the contradictory information, allow me to detail how I handle the situation: since the vast majority of 4-stroke engines have ringed pistons, I break them in as I break in ringed 2-stroke engines for which the words "cool" and "oily" are most important; "cool" is generated by a rich needle setting, and "oily" is provided by the lube percentage (see the previous letter).



Since most manufacturers recommend that their engines be run at  $\frac{1}{2}$  throttle at the beginning, that's what I do—with a rich primary needle-valve setting; this ensures that the connecting-rod bushings and valve-train components are polished up a bit before break-in is attempted for real. I do this for 10 minutes, 2 minutes at a time, with a recommended flight propeller. Undersize props are not used for 4-stroke break-in as they are with 2-strokes; 4-strokes need some flywheel effect (weight) to carry them through the cycle; plus we don't want to float the valves by over-revving. Finally, use the fuel you intend to use for flying.

Next, operate the engine at WOT for relatively short periods (2 minutes) with a rich needle setting (about 1,000 rpm off-peak) while using the same prop and fuel. The idea is to heat the piston/cylinder set and then allow complete cooling, over and over again (full operating temperatures won't develop at  $\frac{1}{2}$  throttle). This is called heat cycling; it stress-relieves the components, and that is what break-in is all about in modern engines.



After at least an hour of running in this manner, peak the rpm (adjust the primary needle valve) and use a tachometer to measure the engine's operation; if it holds steady without misfiring or running roughly, it's probably ready for you to set the idle and check the throttle-up characteristics. Don't waste your time trying to fine-tune the idle before the engine has been completely broken in; in addition to ensuring satisfactory cylinder pressure and torque, a properly seated piston ring controls fuel draw and idling.

### THROWN PROPS

Richard Bond of Apartado De Correos, Spain, writes: Recently, after carefully reading the instructions, I spent several days trying to get a Thunder Tiger .54 to run. Unfortunately, two out of three times, the engine spits back and throws the prop! Then it runs OK if not provoked (e.g., by a quick throttle-up or nose-high operation). I have changed the fuel lines, the tank, the propeller, the glow plug, etc., but nothing works. I can get it running smoky (rich), but after I let it cool down, the next start-up produces a bang, and the prop is loose again! I estimate that this engine has spent about 20 minutes in the air and 12 hours on the test stand. Do you have any suggestions?

Richard, it sure sounds as if you aren't having much fun! The kickback that results in loose and thrown propellers is the result of detonation—a combustion defect. Detonation is produced when the original flame front, which is pressurizing the unburned mixture in front of it, progresses at such a rate that this mixture combusts spontaneously when it reaches its auto-ignition temperature. The burn rate within this zone is many times faster during normal operation; this causes a sharp spike in temperature and pressure before the piston reaches top dead center. In automotive engines, this is referred to as “pinging” or “knocking.” In addition to mechanically damaging the piston crowns, cylinder-head chambers and other engine components, the piston (primarily in single-cylinder engines) is often forced to reverse direction; we know this as “kickback.”

Causes of detonation include lean air/fuel ratio; elevated compression ratio; unsuitable nitromethane content and atmospheric conditions.

- **Air/fuel ratio.** Many 4-stroke engines will detonate if the engine is set too lean; trying to squeeze out the last couple of hundred rpm by screwing in the needle valve a bit more will often produce detonation or kickback, and it may loosen or throw the propeller.
- **Elevated compression ratio.** When a glow engine's compression ratio is increased, the combustion pressure and temperature increase and so does the chance of detonation. To make matters worse, the increased compression forces the ignition process to begin earlier during the compression stroke by adding heat to the plug element. The best fix for an over-compressed, detonating engine is to add head shims to reduce the compression ratio.
- **Nitromethane content.** Nitro is the power-boosting, heat-generating chemical in a glow engine's fuel blend. Although 4-stroke engines generally tolerate greater heat loads than 2-stroke engines, there are limits to the nitro percentage that can be tolerated before the onset of detonation. Depending on the engine's design, using between 20 and 50 percent nitro often requires reducing the compression ratio from that provided by the factory. Do this by adding head shims.
- **Atmospheric conditions.** Detonation often occurs when ambient conditions are hot and dry; conversely, cool, humid days reduce its likelihood. Juggling prop load and/or nitro content will help to control detonation to suit the prevailing conditions.

Never lean the engine to or beyond its maximum rpm. It's very easy to produce a lean, detonation-plagued run; back off a couple of hundred rpm. Before you remove the cylinder head to prepare for the addition of a head shim, try running the engine with less propeller load (diameter and/or pitch); by allowing the engine to speed up, you'll reduce the effective compression ratio and retard the ignition point (both help to reduce the likelihood of detonation and kickback). In addition to taking heat out of the system, reducing the fuel's nitro content automatically retards ignition, and this also reduces the likelihood of detonation.

No, I haven't forgotten the glow plug. There are scores of glow plugs on the market, each with a unique wire element that has a heat-retaining capacity. Since a plug's “heat range” influences the engine's ignition point, your choice of plug can help to provide detonation and kickback control. Unfortunately, there is no universal standard for rating glow plugs' heat-retaining capacity; every plug manufacturer has its own standard. The problem can be simplified by saying that the 4-stroke engine usually requires a very hot plug; the O.S. type F plug has been proven to work well; but don't let this stop you from experimenting with others. ✦

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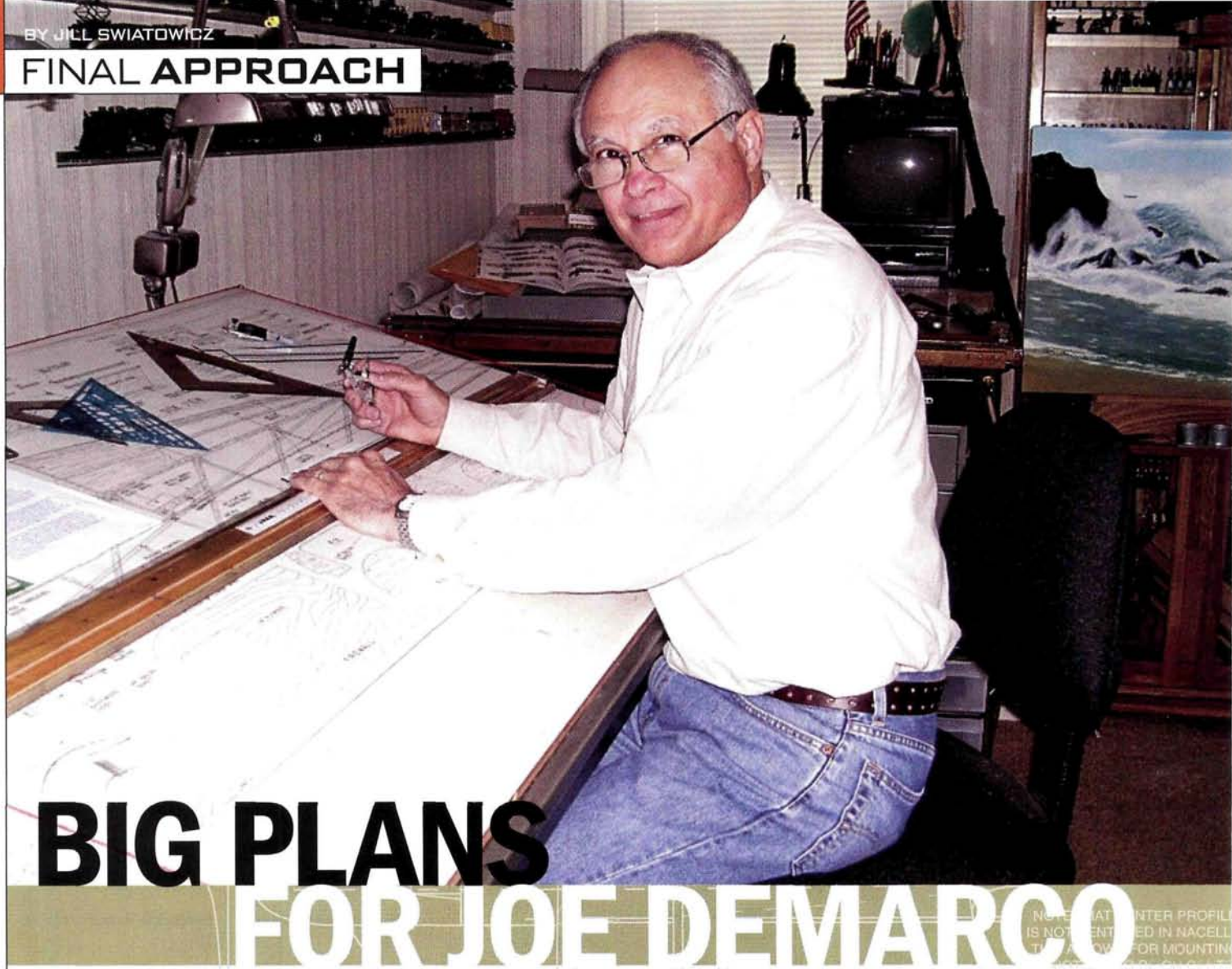
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## FINAL APPROACH



# BIG PLANS FOR JOE DEMARCO

We at *Model Airplane News* are extremely privileged to work with many talented people who share our passion for model airplanes. One such person, Joe Demarco, has been creating plans for *Model Airplane News* and other RC publications for 30 years and recently finished his 1,000th plan: an electric de Havilland Mosquito for an upcoming issue of *Model Airplane News*!

Demarco, who lives in Oceanport, NJ, should be accustomed to success by now. After he graduated from Monmouth College and served four years in the U.S. Navy, he began a 34-year career as a Senior Right-of-Way Agent for Verizon. "[Verizon] couldn't get rid of me," he jokes. "I stayed on another three years as a consultant!" Although his work kept him busy, Demarco and his wife of 38 years, Marie, have raised three children who possess their dad's drive to achieve: their older son practices medicine in New York City, their daughter is a graphic designer in Myrtle Beach, SC, and their younger son is a stockbroker in Philadelphia.

With a full-time job and a family, when does he find the time to draw? "At night, after dinner, I would spend hours drawing ... [an average-size plan] takes 6 to 8 hours." He further explains that it used to take much more time, but with practice comes perfection. The tools help a bit, too. "I draw on Mylar film and use Leroy Lettering stencil ink."

Demarco built his first model at age seven (no, it didn't fly), but it wasn't until 1975 that he drew his first plan. "Bill Winter asked me to draw a plan for him .... After drawing plans for two or three years, I was hooked!"

But that was just the beginning for Demarco. "I have built about two dozen planes, eight or ten of them from my own drawings. I used to buy kits, but I enjoyed designing my own more." Demarco explains that when it comes to model airplanes, he's more interested in control-line and free-flight. Like many of our readers, Demarco also favors scale WW II planes.

In almost 30 years of drawing plans (which have graced the pages of seven magazines!), Demarco has witnessed many developments in modeling. When asked about RC airplane trends over the years, he remembers, "When RC 4-strokes first came out, almost all of the plans I drew were for planes that used those engines. Now, with the popularity of small electric RC, more than 95 percent of the plans I draw are for smaller electrics."

So what does Demarco do in his spare time? You can find him taking classes in oil painting and collecting toy soldiers and electric trains. "I'm just a big kid," he admits with a laugh. When asked what his future holds, he pauses slightly, trying to hold back another chuckle, "I think ... in the fall, my wife and I are going to Disney World." But he adds seriously, "As long as people need me to do [plans], I'll do them." We at *Model Airplane News* congratulate Joe on his 1,000th plan and look forward to many more to come! ✦